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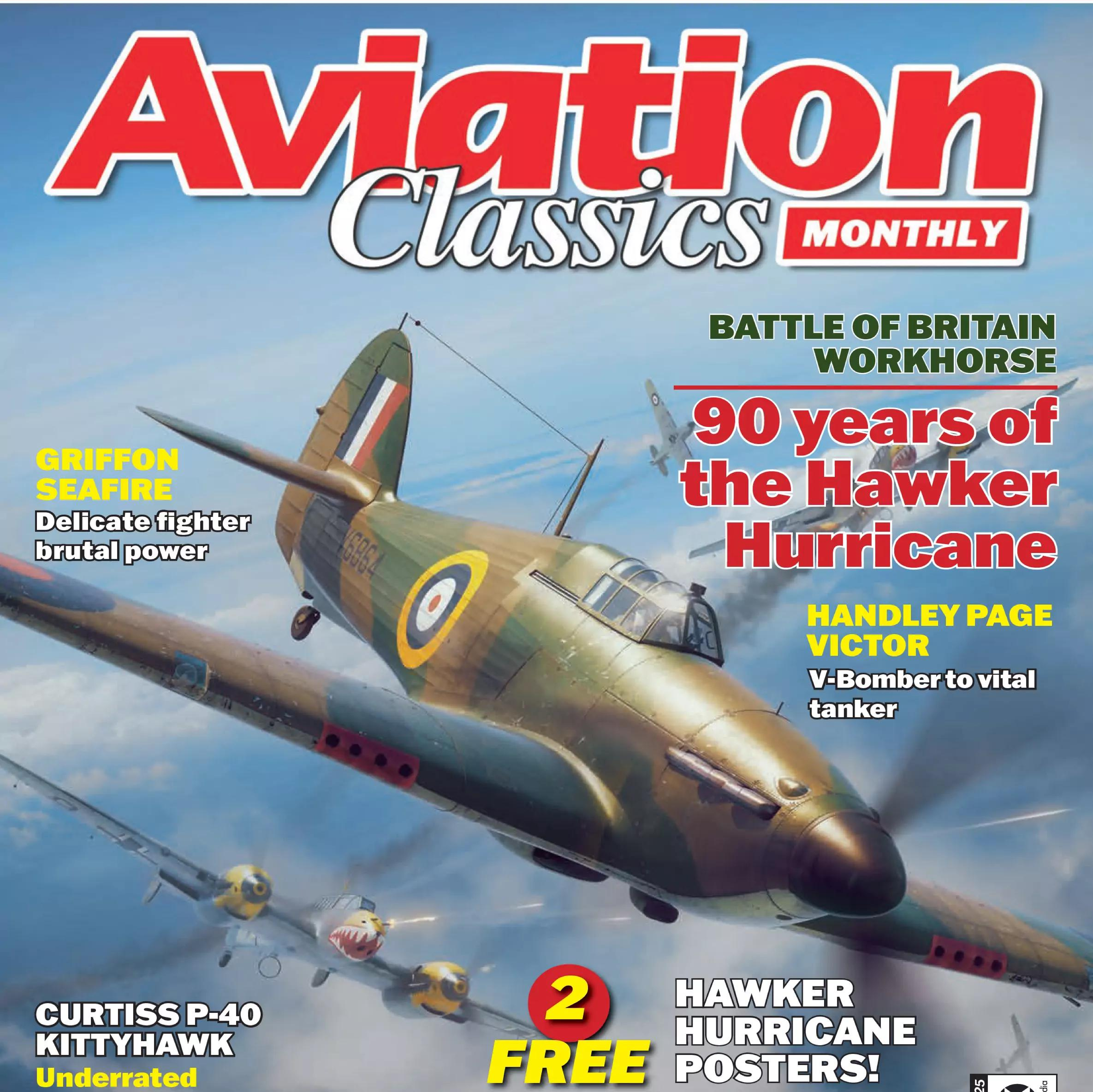

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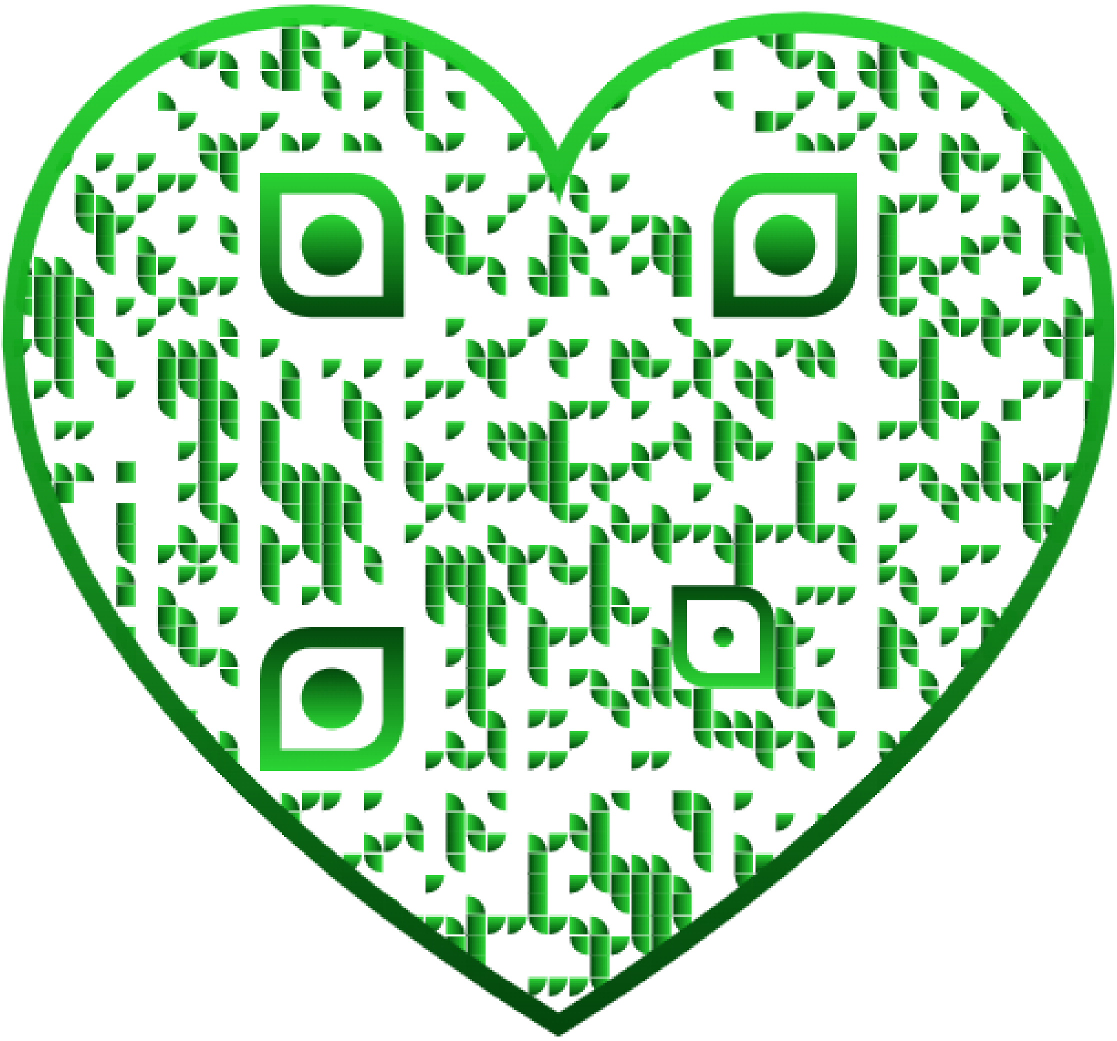

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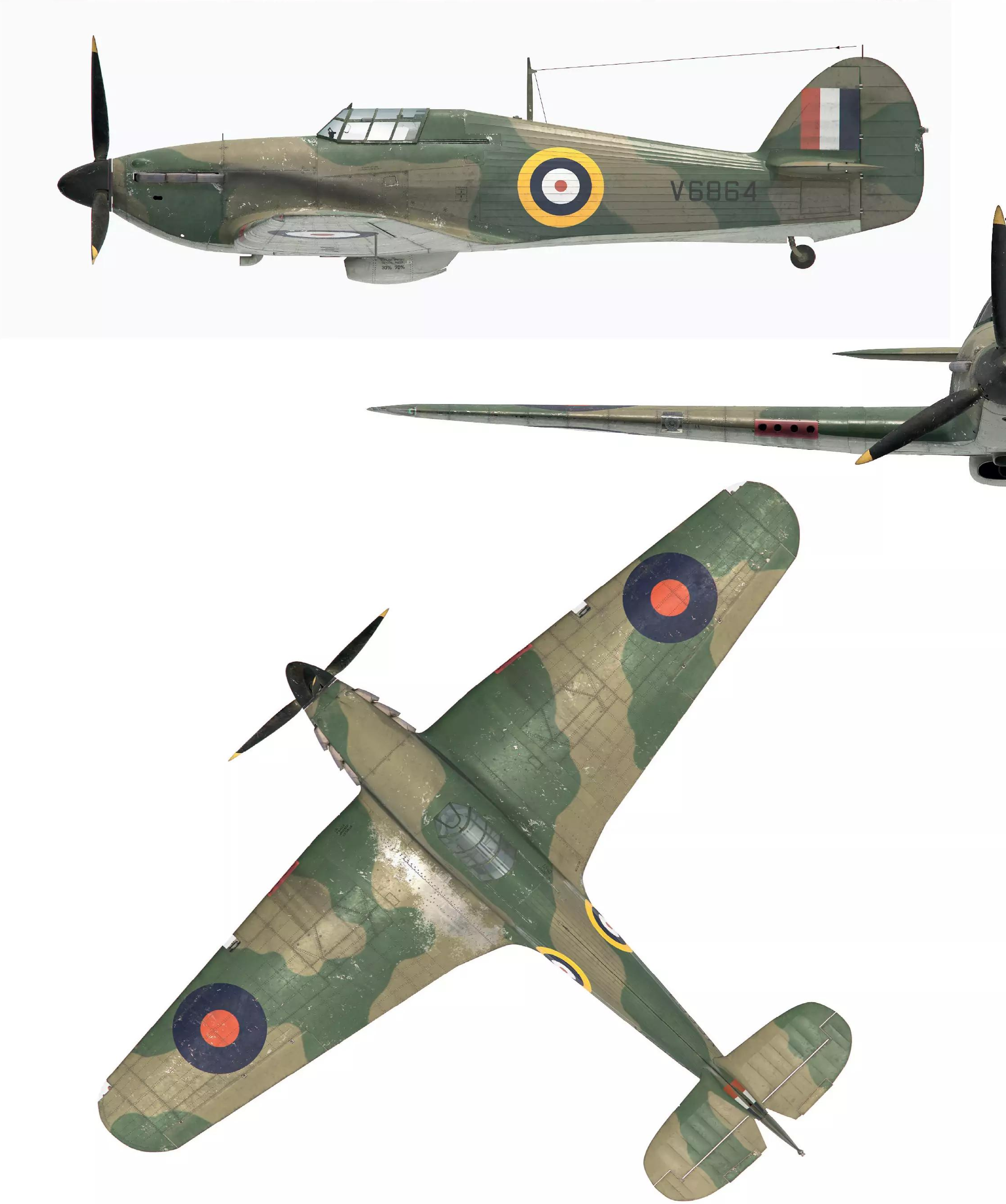

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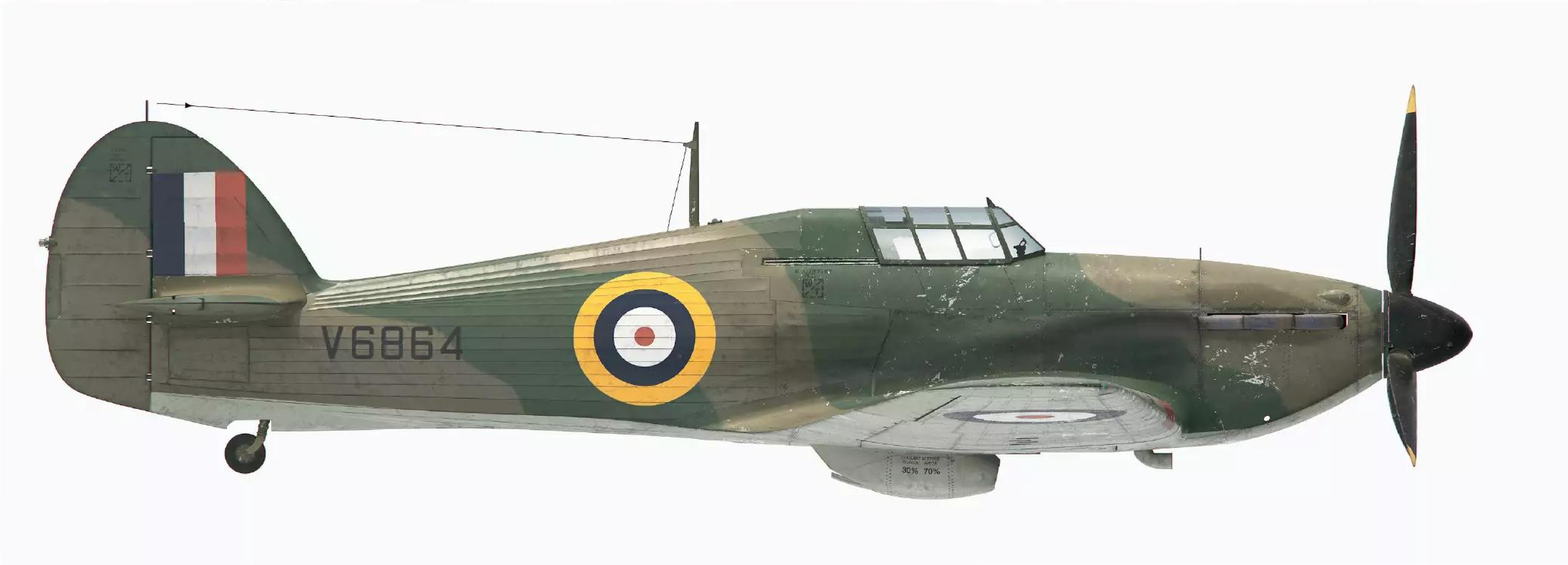

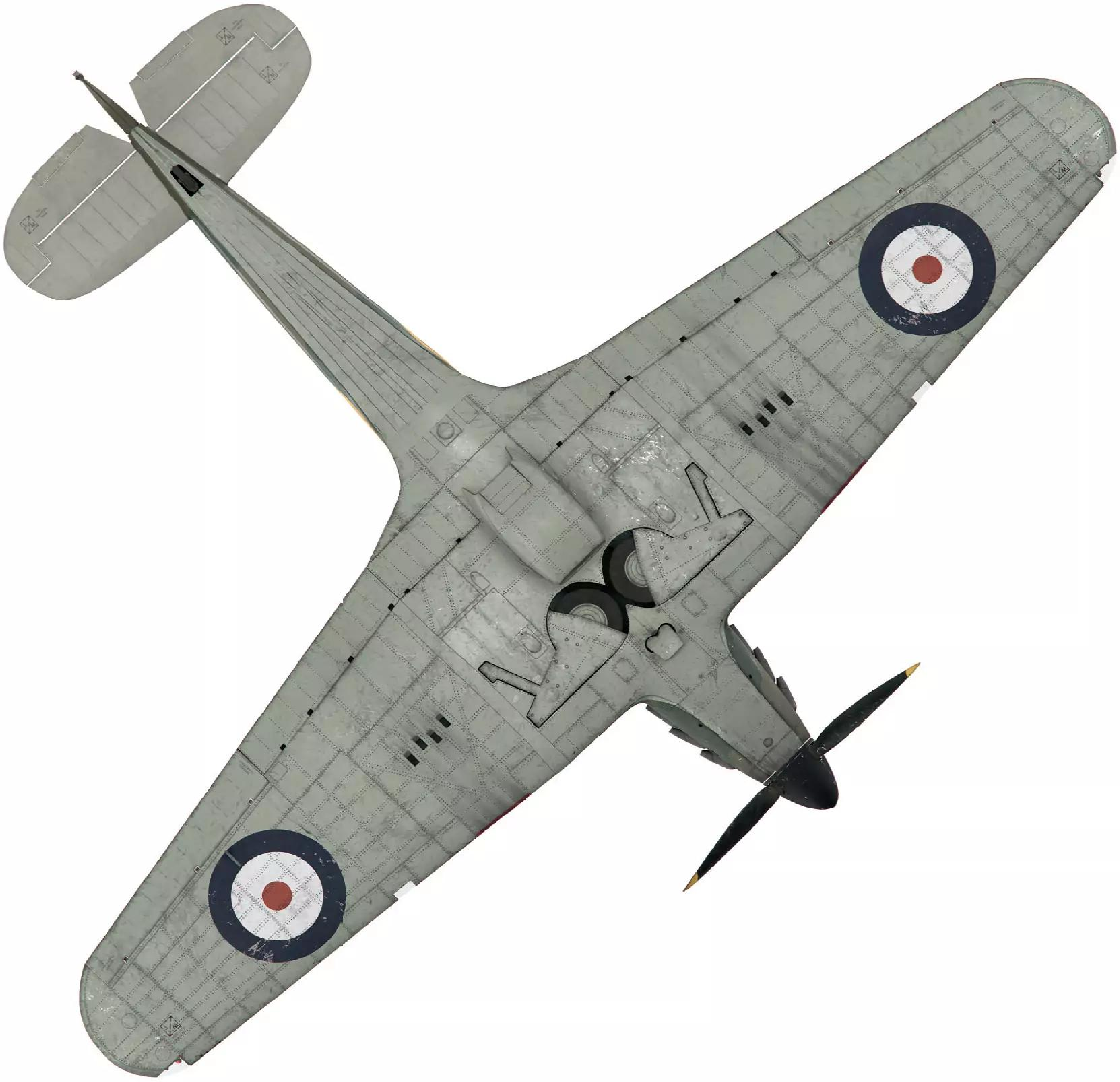

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HAWKER HURRICANE Mk. I

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Empty weight	4,670lb
Max take-off weight	6,600lb
Engine	Rolls-Royce Merlin III
Armament	8 x 0.303 Browning machine guns

Hawker Hurricane

The Hurricane played a crucial role alongside the Spitfire during the intense battles of the summer of 1940. It accounted for more enemy aircraft destroyed in the Battle of Britain than all other air and ground defences combined.

Designed by Hawker Aircraft Company in 1934 and entering service in 1937, the Hurricane offered the RAF a fighter significantly faster and more heavily armed than its predecessors. By the outbreak of war in September 1939, approximately 500 Hurricanes were operational, with several squadrons deployed to France.

During the 1940 German advance through the Low Countries and France, Hurricanes engaged in demanding rearguard actions, resulting in the loss of over 25% of Fighter Command's aircraft.

As the Battle of Britain continued, production increased, and by September 1940, the number of Hurricane squadrons rose from 18 to 32.

Flt Lt J.B. Nicholson of No.249 Squadron received Fighter Command's only Victoria Cross while flying a Hurricane.

Later in the war, Hurricanes contributed significantly to the defence of Malta, the North African campaign, and operations in the Far East. ■

Welcome

Welcome to the third issue of Aviation Classics Monthly.

Ninety years ago, in November 1935, the first Hawker Hurricane prototype made its flight debut with test pilot George Bulman at the controls. Less than five years later it would be on the front line during the Battle of Britain.

This month's superb cover image, by Piotr Forkaziewicz shows famous author Roald Dahl's Hurricane I, V7826, on 20 April 1941 during the so-called Battle of Athens – as he duelled Messerschmitts above Athens, Greece.

With German forces closing in on the Greek capital, the dozen or so remaining RAF Hurricanes in theatre were ordered to fly over the city – where they encountered a force of Ju 87 and Ju 88 bombers, escorted by Bf 109 and Bf 110 fighters, nearly 100 aircraft in all.

In the ensuing dogfight, the RAF lost five aircraft with four of the pilots killed, including formation leader Marmaduke 'Pat' Pattle – an ace with more than 40 victories. The Germans suffered at least eight losses. Dahl himself survived, of course.

In celebration of the Hurricane's landmark year, this issue includes histories of the type's development and service career, as well as a report on the construction of a new replica.

You will also find a feature on the excellent Handley Page Victor, detailed pieces on the RAF's refuellers, Supermarine's rather surprising bombers and much more.

If you like what you see, why not subscribe? See pages 74-75 for details.

Enjoy the magazine.

Charlie

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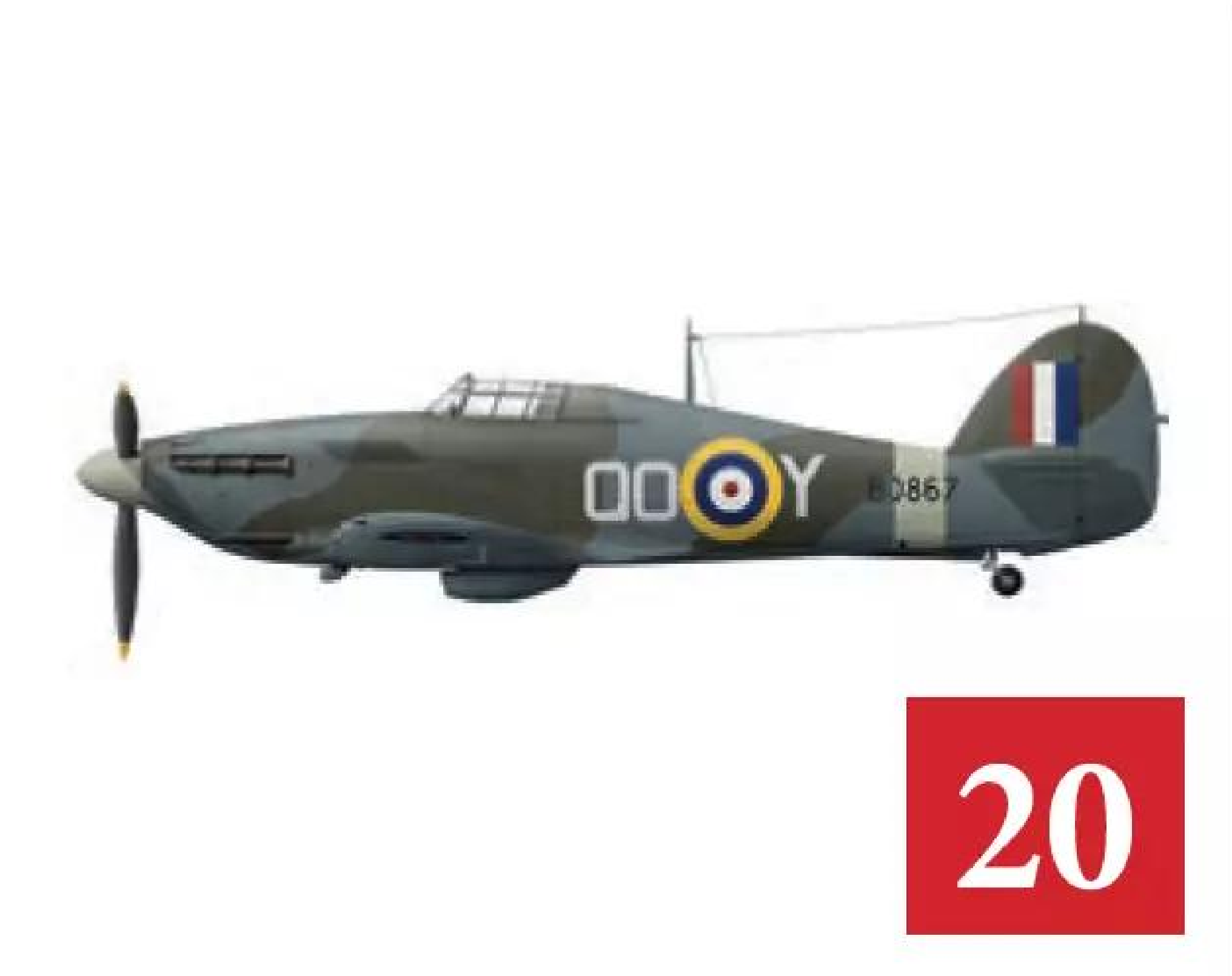

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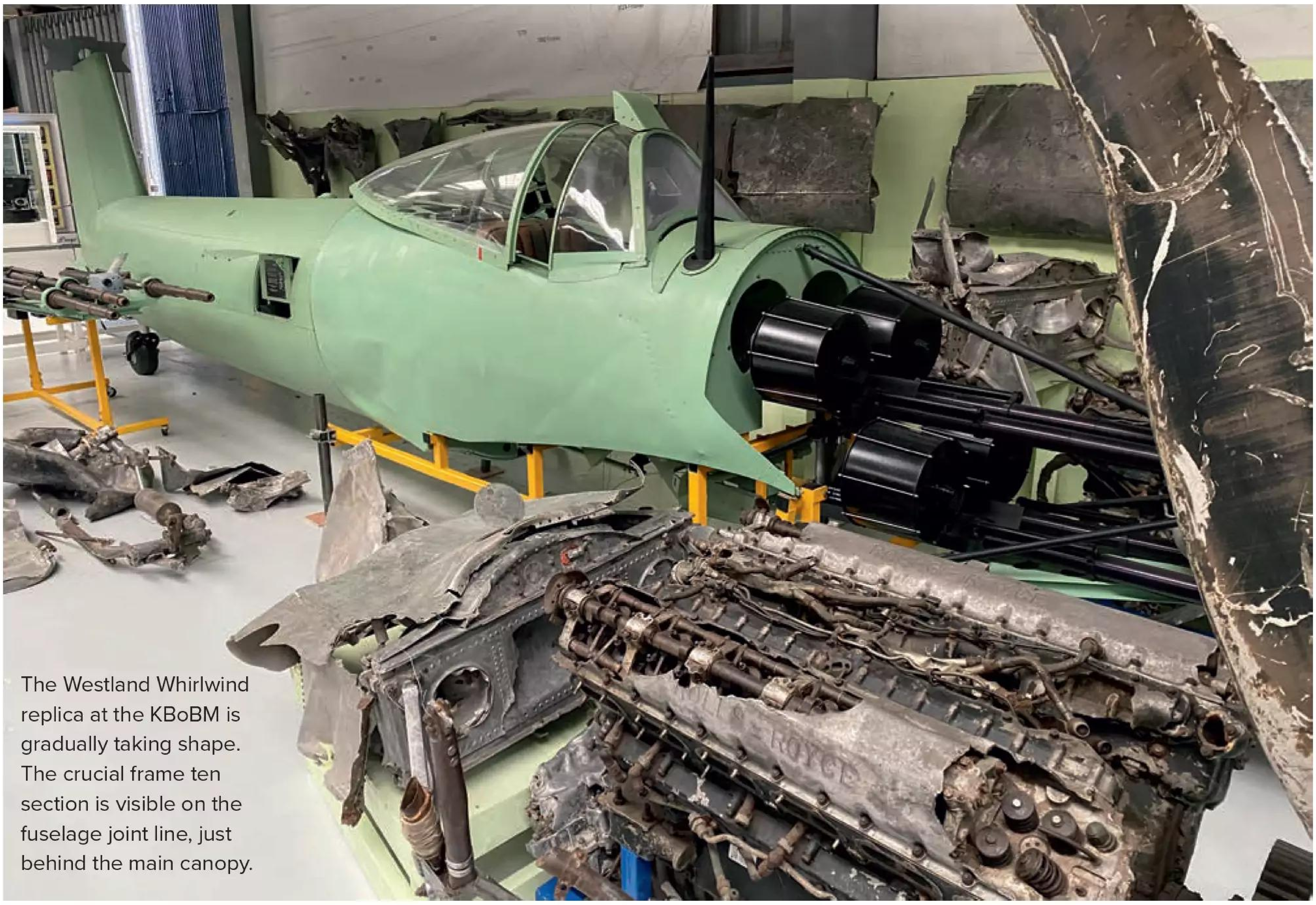
Whirlwind's complexity and ingenuity rediscovered as rebuild progresses



The Westland Whirlwind replica at the KBoBM is gradually taking shape. The crucial frame ten section is visible on the fuselage joint line, just behind the main canopy.

The announcement by the Kent Battle of Britain Museum (KBoBM) that the Westland Whirlwind Fighter Project based there is making good progress – following the recent attachment of the tail section to the fuselage – along with an invitation from the museum to *Aviation Classics Monthly* to see the progress up close and discuss the current work with Chief Engineer Pete Smith, was too good to miss.

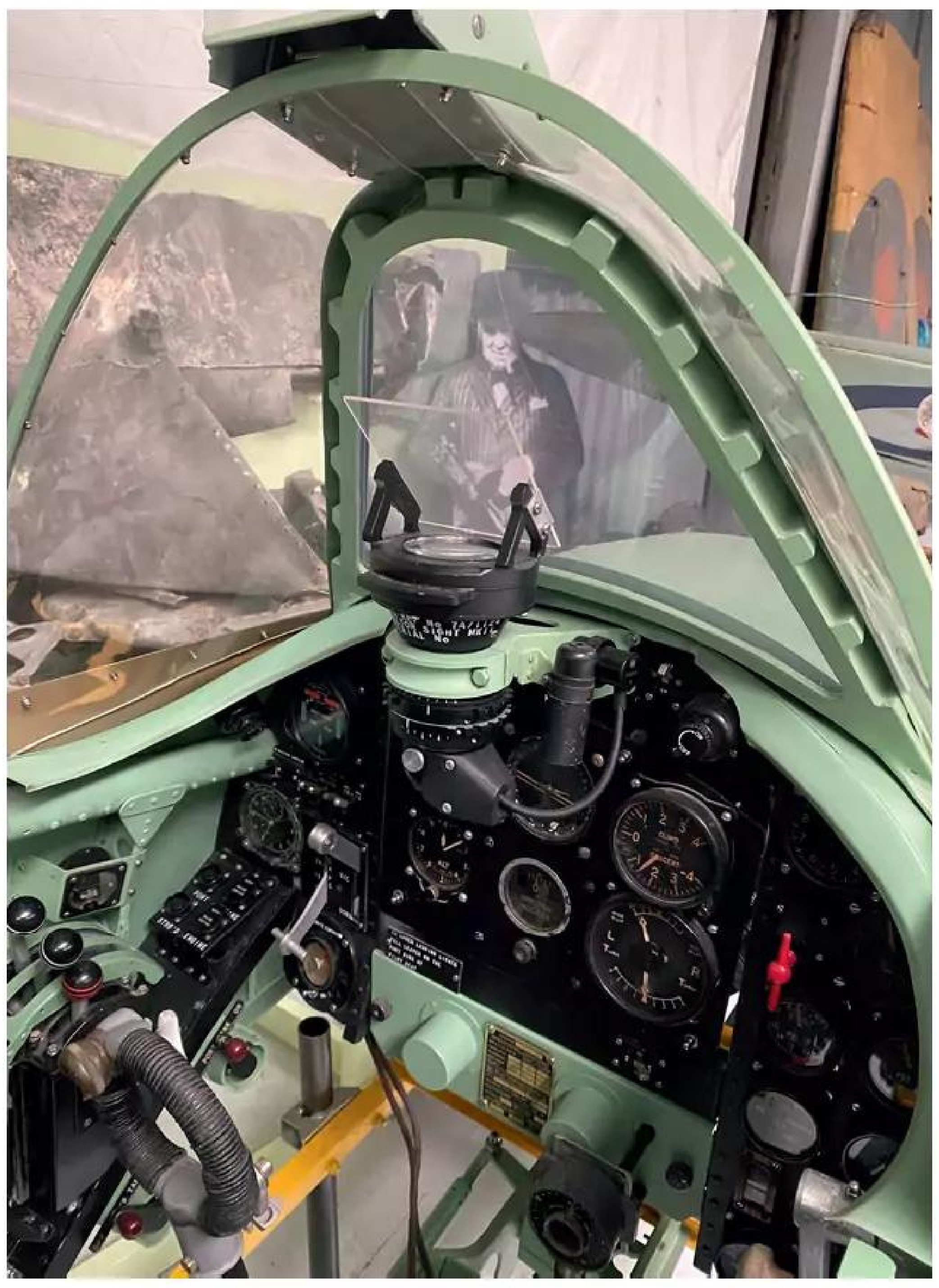
At the very beginning of the project, there was a specific construction procedure that had to be followed, partly because of how the original Westland Whirlwinds were built for the RAF during World War Two. Smith explains: "With the Whirlwind, you simply can't start by building the rear fuselage first; you must begin with the cockpit section because the angle of 'frame ten' on the fuselage is critical. This frame, located at the rear of the cockpit, supports the longerons for that area and serves as the main foundation for the entire rear fuselage. It involved constructing the cockpit area, along with the nose first, and due to the modular construction approach, we would then assemble the fuselage around frame ten.

"Unlike the Spitfire, the Whirlwind fuselage is a complete monocoque; there's nothing inside it, it's simply a tube. Therefore, everything must be fitted exactly right, or it will twist, and nothing will line up as you go further."

The cockpit section took around 18 months to complete starting in 2023, and once finished, it was transported to the museum. The rear fuselage was completed a year later, and the two sections were joined. Despite the work being done about 300 miles from the museum, in his workshop, Smith said that both sections fit perfectly once mated.

For a project that only entered its initial phases in late autumn 2021, after the now retired Smith reorganised his former engineering business – sold but still retaining the machinery – into a facility capable of constructing large aircraft sections, the project truly gained momentum. The complexity involved in this rebuild shows how intricate the Westland Whirlwind was during its service. Smith notes that an RAF ground crew of ten was required to service a single aircraft, compared to just three for a Spitfire or Hurricane. Despite the innovative technology that Westland introduced under the leadership of W.E.W. 'Teddy' Peter, Smith highlights the sheer complexity involved.

"The recent attachment of the tail, which included the tail wheel undercarriage strut – one of the earliest retractable undercarriages for its time – demonstrated how complex the system was. It's a hydraulic leg system that the ground crew disliked. This was because it was operated from the front of the strut inside the fuselage, where there's a



The fully completed cockpit indicates how the finished Whirlwind will appear when it is finally mounted on its main undercarriage and displayed at the museum.

The rear tail section, fitted flawlessly, demonstrates the incredible work that chief engineer for the project Peter Smith has accomplished so far.

The debate over whether Merlin engines would have improved the Whirlwind aircraft is a non-issue. The ground clearance of the 10ft diameter propellers used on the Peregrine was just an inch during take-off and landing. Merlins would have required 11ft diameter blades.

jack that pivots. What you have is a pivot moving around another pivot, linked to the tail wheel undercarriage doors at the same time. To service the jack – since it's located inside and required frequent attention – and because it only operated correctly at 440 psi, the ground crew had to find the smallest member, remove the pilot's seat, parachute flare tubes, and other cockpit components, then have the designated maintainer crawl inside the fuselage to service the jack. Afterwards, everything had to be refitted.” Smith continues, “Its construction is difficult because it was so innovative for its day. It was a leader in aircraft design because it's a full monocoque.”

Regarding sourcing information about the Whirlwind to ensure the replica is as true to the original as possible, Smith states: “There are no original engineering drawings, as they were all destroyed in a flood at Westlands. We did get in touch with them, but they had nothing left, only passing a few general assembly drawings which they had handed over to Airfix to make a model from. So, we obtained some of the original Westland drawings from Airfix, which allowed us to take some dimensions for constructing certain parts. However, they aren't really proper engineering drawings.

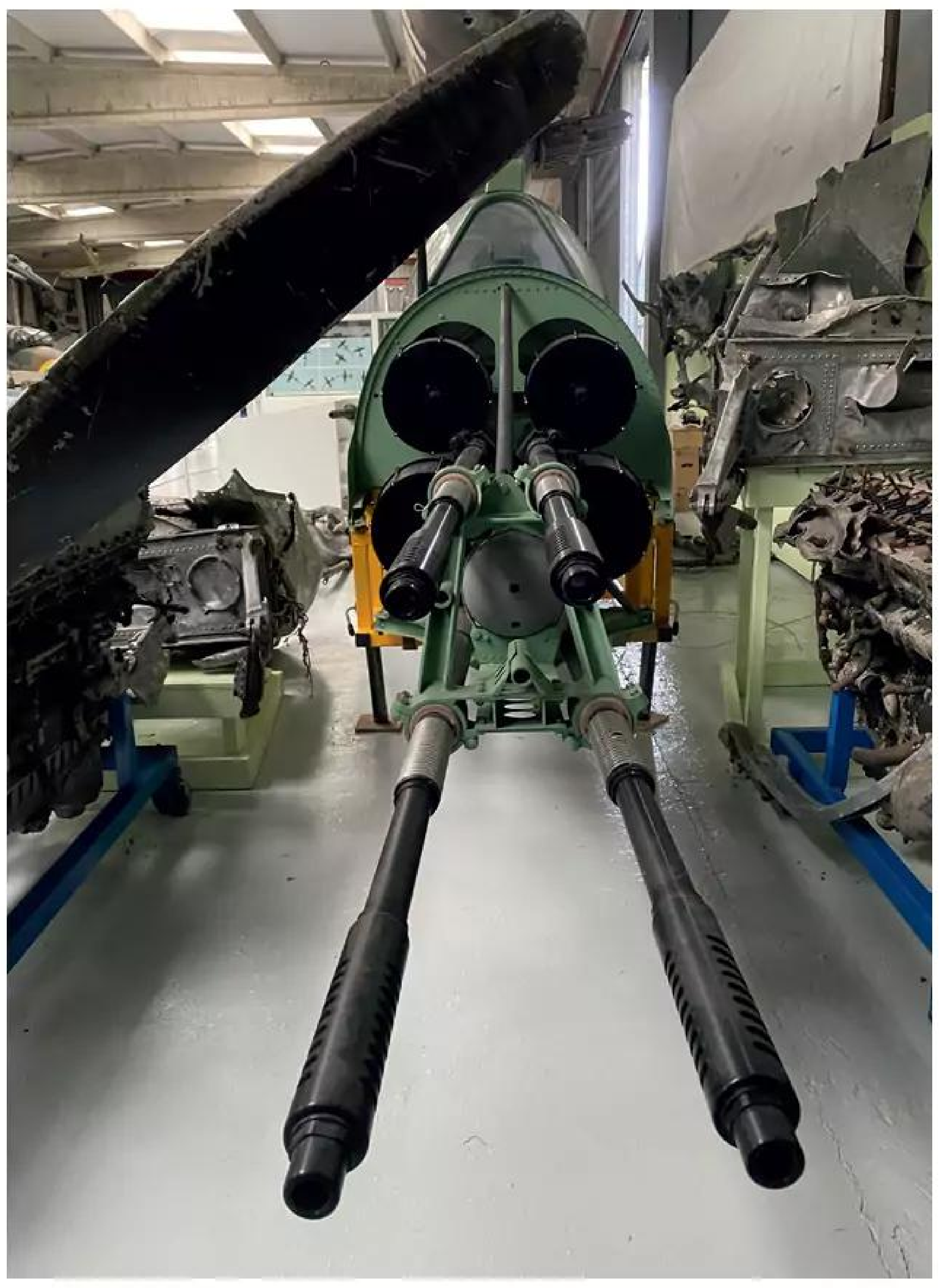
“But we had an agreement with Westland before Leonardo took over: as long as we weren't building the aircraft to fly – which we weren't, of course – they still held all the aerodynamic test data, which showed the outside profile of the Whirlwind in great detail.

“So, from the Ministry of Aircraft Publication manuals, we have numerous images of how it was built, and that allowed us to re-engineer project parts using the aerodynamic data we now possessed, probably with 95 per cent accuracy.”

Discussing the recently added tail section and what is to be added next in this area, Smith comments: “Because of the modular design, you cannot really build the next piece without knowing if the other part fits, in this case the tail. The crosspiece that sits at the top of the tail is a complex casting or fabrication that joins the fin to the tailplane. At Westland's, it would have been made as one piece. But to ensure ours fits and everything aligns, we have already built the centre section of the tailplane and the spars, because it has to support all the trimming, the elevator, and the rudder gear, as it is mounted high.

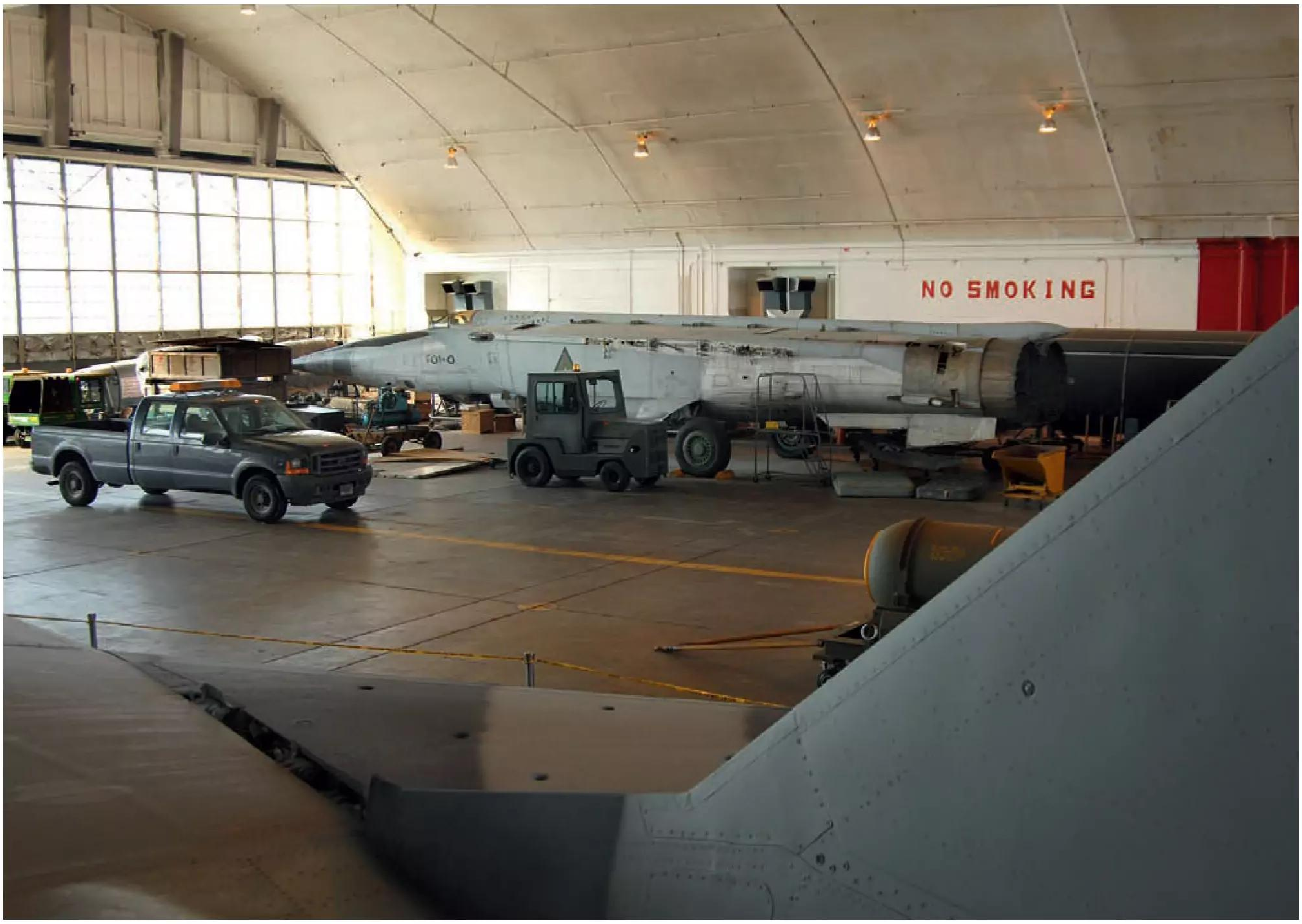
“So, while we were building the tail, everything connected to it, such as the tailplane, was constructed simultaneously, complete with the spars and the top of the fin, along with the rudder's ‘nose’. An interesting feature of the rudder is that its leading edge is a triangle that fits inside the fin. At the time, it was considered to be aerodynamically superior to having a rounded edge. Westland was quite skilled at coming up with innovative ideas; they just weren't very successful at implementing them.”

The work so far on the Westland Whirlwind is ultimately aimed at producing a finished aircraft that looks as if it has just left the Westland factory; fully equipped, like the cockpit now, complete with radio gear and related IFF equipment, and utilising, where possible, restored and recovered instrumentation. As Smith states: “We are building the aircraft's structure to airworthy standards, but it won't fly of course. But, we're building this as though it's the last production Whirlwind ever made.”



RAF ground crews, when changing the ammunition on the Whirlwind, had to remove the entire nose section to access the empty magazines. The cannons were notorious for jamming when fired.

All images credit: Glenn Sands



During its recovery following the 1991 Gulf War, USAF personnel were unable to locate the main wings of any of the Foxbats found at the Iraqi air base. *Credit: National Museum of the USAF*

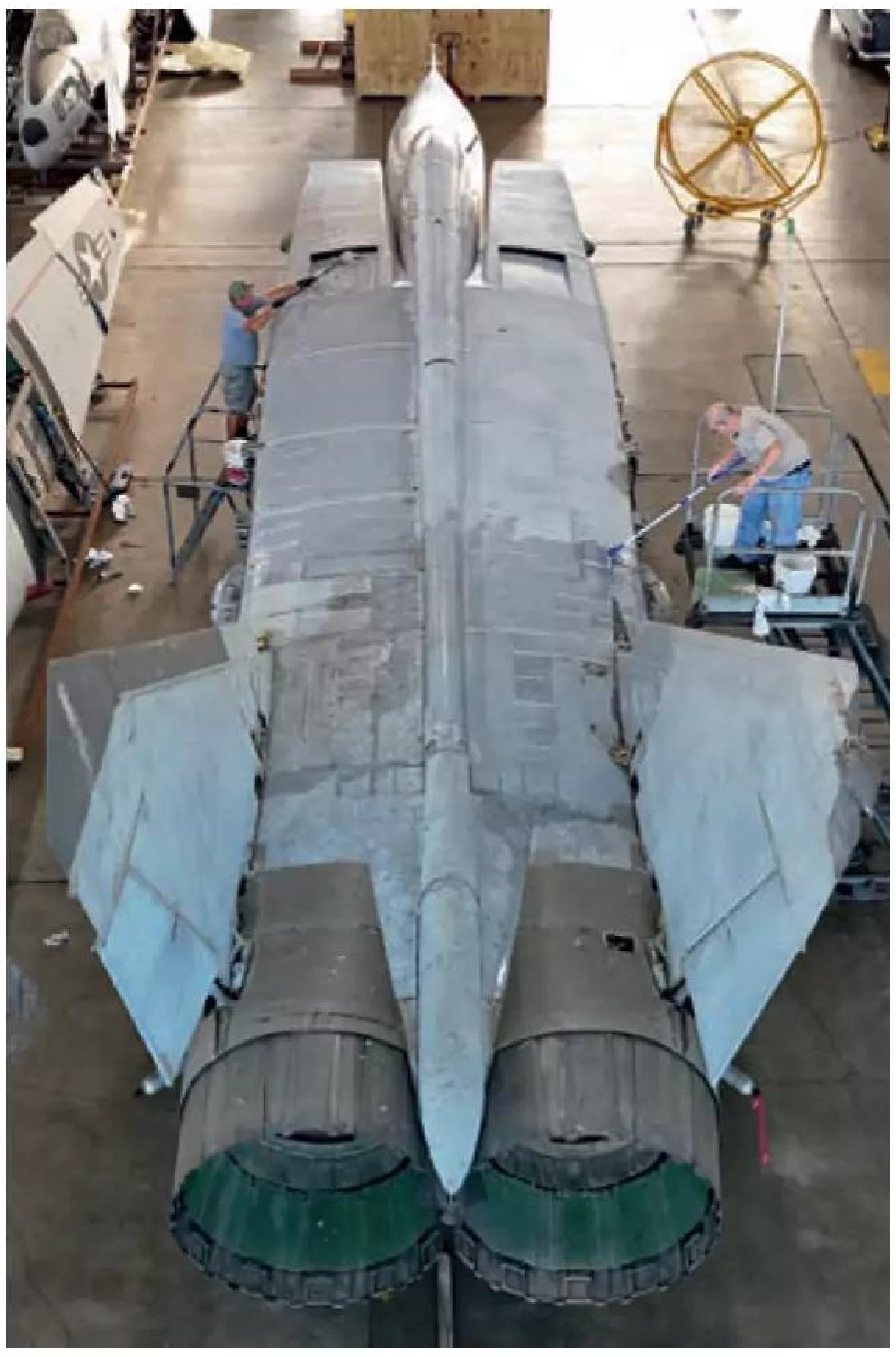
Wingless Foxbat-B buried by Saddam is restored and ready for display at last

The National Museum of the USAF at Wright-Patterson AFB, Dayton, Ohio, has announced that, after 20 years in storage, it will display its Mikoyan-Gurevich MiG-25 Foxbat to the public.

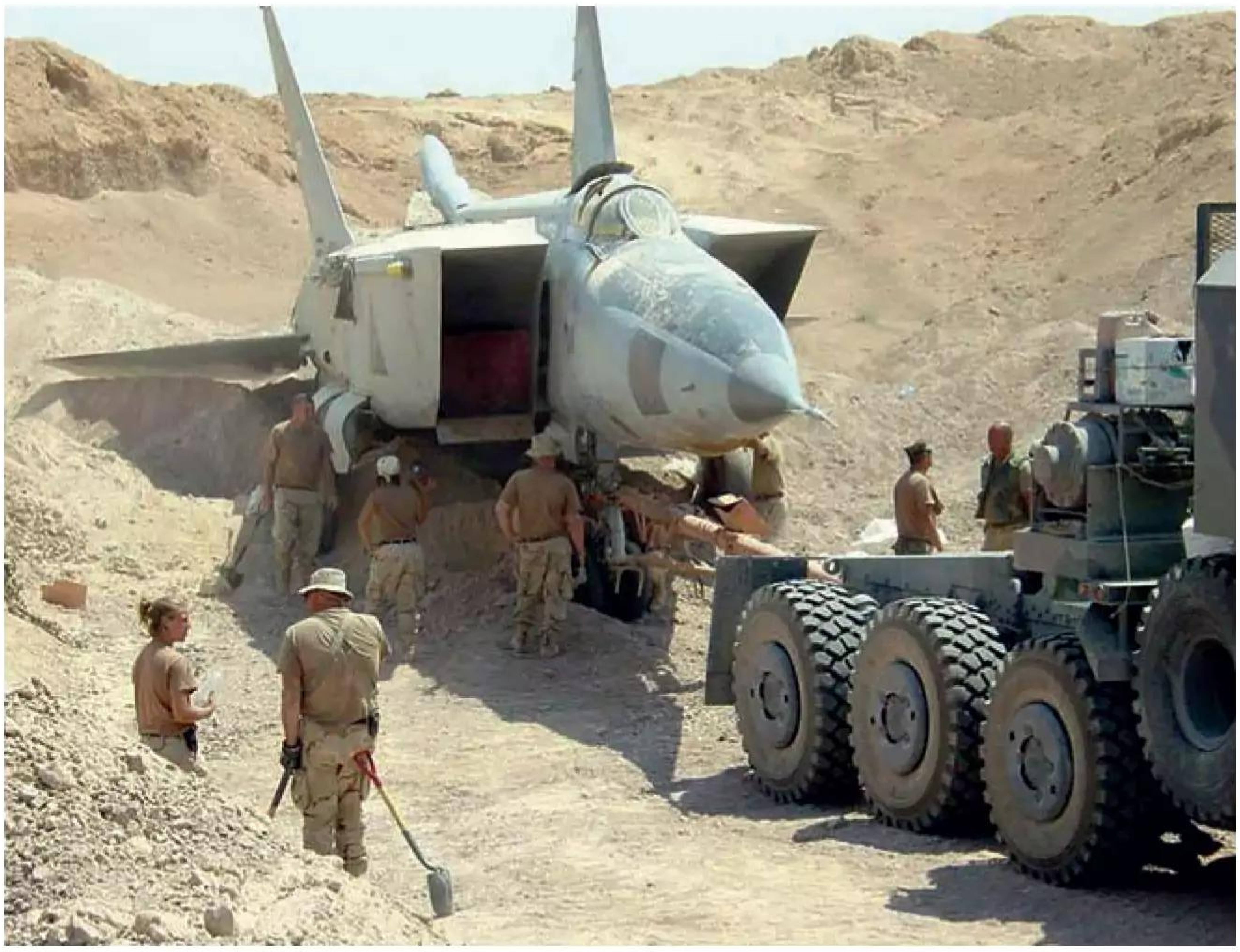
Acquired in 2006, the Foxbat has remained in storage since arriving at the museum. It is a rare MiG-25RB single-seat reconnaissance bomber, designated Foxbat-B by NATO. This aircraft was exported to Iraq by the Soviet Union. The Iraqi Air Force received its reconnaissance variants of the Foxbat between 1985 and 1986, operating within No.17 FRS, and in the early 1990s, flew several missions over Jordan and Saudi Arabia.

The Iraqi Air Force lost at least four Foxbats during the 1991 Gulf War, either shot down or destroyed on the ground. In an attempt to save some of the Foxbats from being destroyed by USAF fighters, the Iraqis buried the aircraft, including MiG-25RB s/n 020657.

When US forces took control of Al-Taqaddum Air Base, 46 miles (74 km) west of Baghdad, the American troops discovered the partly buried Foxbats, missing their

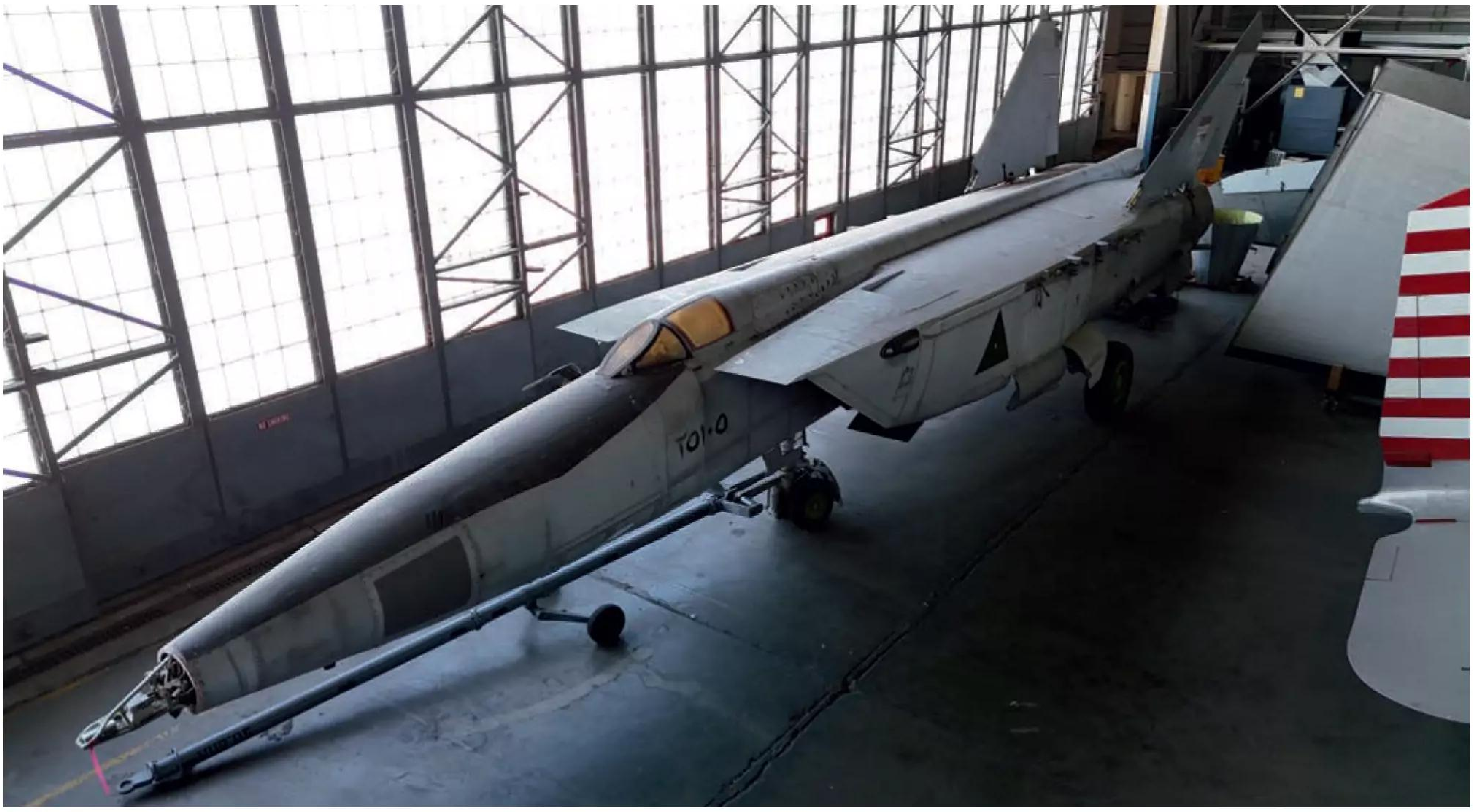


The former Iraqi Air Force MiG-25RB Foxbat-B is undergoing refurbishment before being displayed temporarily at the National Museum of the US Air Force. *Credit: National Museum of the USAF*



A US military search team prepares to remove one of the buried MiG-25 Foxbats from Al-Taqaddum Air Base. *Credit: MSgt T. Collins USAF*

Head-on view of the Foxbat-B on display. *Credit: National Museum of the USAF*



Mikoyan-Gurevich MiG-25RB Foxbat-B s/n 020657 in the museum's storage hangar at Wright-Patterson AFB. *Credit: National Museum of the USAF*

wings which were never found, in the sand.

Foxbat s/n 020657 was found to be in the best condition and was loaded onto a US transport aircraft for evaluation at Wright-Patterson AFB.

In mid-2006, the Foxbat was officially transferred to the National Museum of the USAF, where it has remained in storage ever since, partly due to its incomplete condition.

The museum initially planned to display the MiG-25 on 7 October after it had been refurbished, as part of a temporary exhibition. However, following the closure of the National Museum of the USAF due to the US Government shutdown that began on 1 October, the Foxbat will remain within the museum's restoration hangar until further notice.

Once the museum reopens to visitors, the National Museum of the USAF will offer the chance to see the only MiG-25 Foxbat in the United States. It is hoped that the new exhibition, which includes the Foxbat, will eventually become a permanent feature.

Boxes of bits becoming a Shackleton

The Yorkshire Air Museum (YAM) has provided an update on the exceptional progress made so far this year with the rebuild and restoration of their Avro Shackleton MR Mk 2, WR963. Leading the programme is Richard Woods: "Since the beginning of the year, and with the arrival of some good weather, we have been working steadily and diligently behind the hangar, focused on turning the six lorryloads of Shackleton parts into something that resembles an aeroplane again!

"The first task was to position the centre section in the middle of the assembly area. As it's the heart of the aircraft, everything is added outward from this. The rear fuselage section was attached in March, with the cockpit awaiting until repair work along the bomb bay floor was completed – carried out to a high standard by members of the YAM Engineering volunteers and the Shackleton team.

"This repair work culminated in a momentous day in May when the cockpit was lifted and reattached to the centre section, giving us a complete fuselage from end to end since the cold days of January and Coventry!

"In August, we realigned the fuselage to be more level, finally enabling us to remove the stacks of pallets under the bomb bay. We decided to refit the horizontal stabilisers and the two tail fins, and suddenly WR963 looked much larger…! The No. 2 and No. 3 engines were positioned in place, ready to be fitted after cleaning the firewalls and connections.

"Continuing elsewhere, hundreds of bolts have been refitted, ensuring everything is secure. Some redundant wiring for the AEW equipment has been removed (as it has not been operational since 1991), allowing us to focus on the systems that keep WR963 running – engine services, lighting, hydraulics, pneumatics, and so forth. This essential internal work is likely to continue into winter and into 2026.

Volunteers for Project Shackleton prepare the inboard engines of WR963 before attaching them. *Credit: Yorkshire Air Museum*

"The rest of this year's work will involve refitting the two inboard engines, the inboard wing trailing edges, and if weather and time permit, we hope to lift WR963 back onto her own undercarriage – aiming to have her on her wheels by Christmas!

"Looking ahead, 2026 will involve refitting the outer wing sections, and 2027 will focus on the two remaining engines, propellers, and a fresh coat of paint."

Falklands Pucará settling in to new home alongside fellow veterans

The South Yorkshire Aircraft Museum has announced the arrival of ex-Argentine FMA Pucará 'A-515' to join our Falklands War display '11 Weeks in 1982' – the UK's largest permanent exhibition dedicated to the conflict.

Flying with the Argentine Air Force (Fuerza Aérea Argentina) from the Falkland Islands, A-515 participated in several missions during the war against British forces, including the final Pucará sortie on 10 June. During this operation, the aircraft was lightly damaged by small arms fire and did not fly again before the Argentine surrender on 14 June.

Captured by British forces at the end of the conflict, the Pucará was returned to the UK for trials and evaluation at the Aircraft and Armament Experimental Establishment (A&AEE) at MOD Boscombe Down. After extensive assessment to determine its airworthiness, A-515 was allocated the RAF serial ZD485 and flown for approximately 25 hours in the UK, making it the only captured Pucará to be flown there.

After three days of disassembly at RAF Cosford and being transported by road to the museum, volunteers had the major parts of the Pucará reassembled by the end of the first day after its arrival. *Credit: South Yorkshire Aircraft Museum*

After completing the trial work, A-515 was flown to the RAF Museum at RAF Cosford on 9 September 1983. A-515 remained part of the RAF Museum collection until it was transferred to the South Yorkshire Aircraft Museum in October 2025.

Joining the South Yorkshire Aircraft Museum's '11 weeks in 1982' display, Pucará A-515 is now exhibited alongside several other veteran aircraft from both sides of the Falklands War and a memorial dedicated to the 255 British servicemen and three islanders killed during the conflict. Volunteers have rebuilt the Pucará and it is currently on display outside, but there are plans to move it undercover in future museum developments.

South Yorkshire Aircraft Museum curator Naylan Moore said, "The acquisition of the Pucará is a fantastic addition to our '11 Weeks in 1982' display, joining several other aircraft that flew on both sides of the conflict. This will allow us to further share the story of the Falklands War with our visitors and honour those that made the ultimate sacrifice."

Dr Harry Raffal, Head of Collections and Research at the RAF Museum, said: "The RAF Museum's gift of the Pucará A-515 will provide the South Yorkshire Aircraft Museum with an exciting new exhibit. The Pucará was operated by the Fuerza Aérea Argentina during the Falklands War, although not in direct contact with the RAF. The gift will share the Pucará story with new audiences and broaden the understanding of the Falklands War."

Rare airworthy WW2 Harpoon 'Island Doll' prepped for move to Virginia Beach

The Lockheed PV-2 Harpoon will be restored to flight and eventually displayed to the public, safeguarding an important chapter of naval aviation history. *Credit: via Military Aviation Museum/American Military Heritage Foundation*

The Military Aviation Museum in Virginia Beach has announced the addition of a rare Lockheed PV-2 Harpoon, known as '*Island Doll*', to its growing collection of historic aircraft. The PV-2 Harpoon was a long-range US Navy patrol bomber used during World War II, especially in the Northern Pacific theatre. Operating from bases in the Aleutian Islands, Harpoon and Ventura crews carried out what became known as 'The Empire Express' missions – dangerous long-range sorties flown in freezing temperatures and bad weather. These operations were essential in keeping Japanese forces occupied far from the main Pacific battlefields.

Island Doll was preparing for deployment to the Aleutians from Naval Air Station Whidbey Island when the war ended, leaving it without a designated combat mission. Since the mid-1980s, the aircraft had been cared for by the American Military Heritage Foundation (AMHF) in Indiana. The organisation successfully listed the aircraft on the National Register of Historic Places and displayed it at airshows across the Midwest. However, the foundation faced significant setbacks during the Covid-19 pandemic, losing volunteers and income from tours and public appearances.

Earlier this year, the AMHF board decided to find a new home for the Harpoon to ensure its preservation and ongoing flight. After reviewing several proposals, the foundation selected the Military Aviation Museum as the aircraft's new custodian. Factors influencing the decision included the museum's ability to keep the aircraft flying, its available space, and the resources to manage the aircraft and its parts.

"We are honoured to have been selected as the future home for the PV-2 Harpoon," said Keegan Chetwynd, Director of the Military Aviation Museum. Speaking from Indiana, where he and a team of museum volunteers and Fighter Factory mechanics are preparing the aircraft for its relocation, Chetwynd noted that the Harpoon will soon be ready for flight and its eventual journey to Virginia Beach. Support for the project has come from Vintage Flying Machines of Huntington, Indiana, and the Jet Access team at Indianapolis Regional Airport, which provided hangar space during the restoration process. The museum has launched a fundraising campaign to help offset the costs of transporting the Harpoon to Virginia, with an anonymous Virginia Beach donor pledging to match contributions.

Once at the museum, it will be temporarily stored at the museum's Suffolk facility before being displayed in Virginia Beach.

NEWS IN BRIEF

Legendary cold warriors are returned to Bruggen

RAF Bruggen was a key part of Cold War operations as a RAF station in Germany, hosting all frontline aircraft during its service, which defined that era. Now, thanks to RAF Heritage, a Sepecat Jaguar GR1 and a Panavia Tornado GR4 have returned to the air base to be displayed with the new museum celebrating the station's remarkable legacy.

Thanks to RAF Heritage and the skilled team from Joint Aircraft Recovery and Transportation Squadron (JARTS), the aircraft were transported by road and are now restored with assistance from German and Dutch Air Force colleagues, demonstrating NATO cooperation across borders. Both aircraft are now securely stored on-site as plans for the new museum develop.

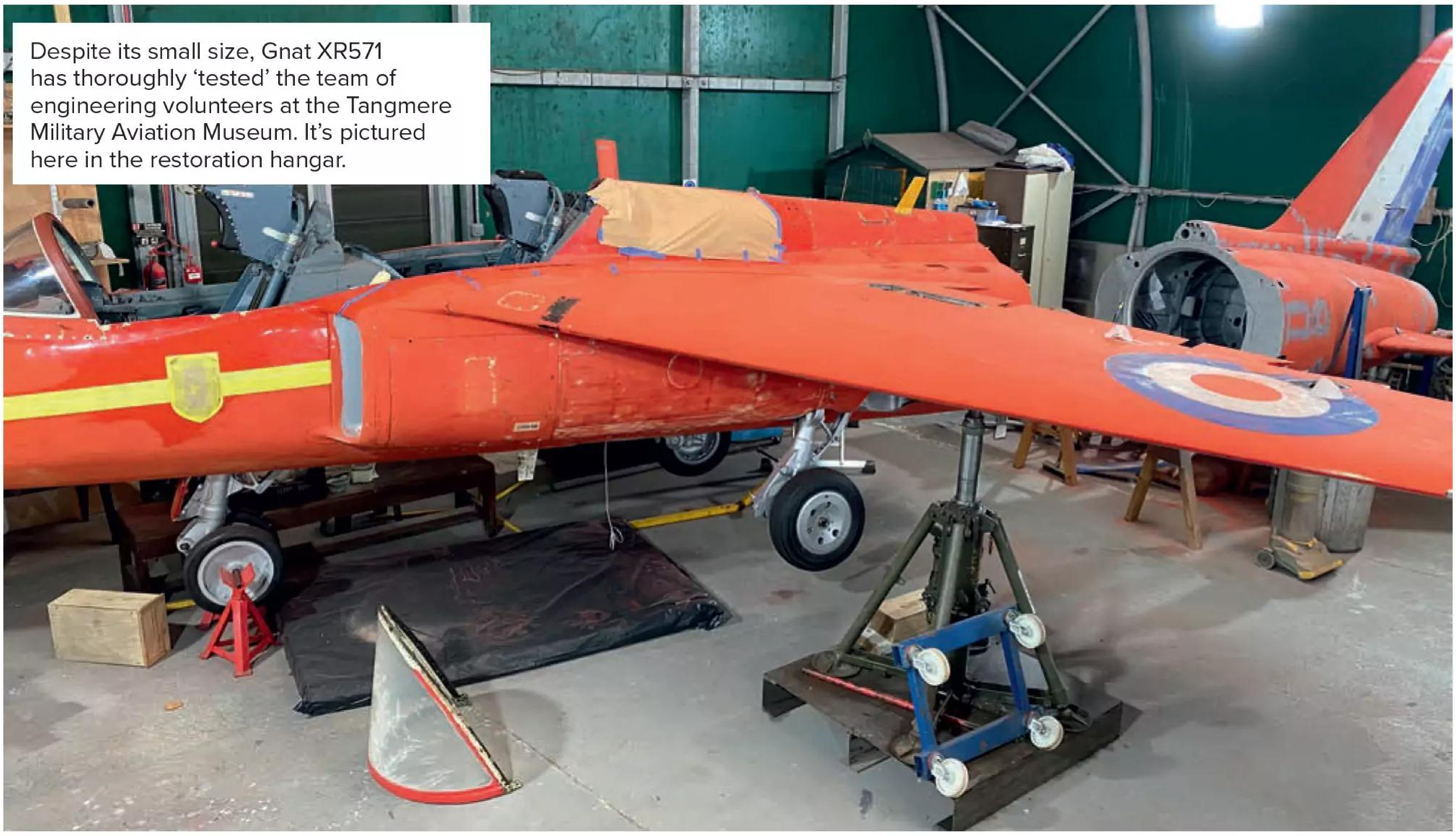
RN anti-sub Sea King joins museum lineup

The Helicopter Museum at Weston-super-Mare has recently acquired a Westland Sea King HU5 from HMS *Sultan* in Gosport, where it served as a ground instruction airframe. Delivered to the museum by road, the HU5 ZA133 previously served aboard HMS *Hermes* and RFA *Fort Austin* during the Falklands War in 1982 in the anti-submarine warfare role. It was later converted to the helicopter utility (HU) role and served in Bosnia and the Gulf before being retired in 2006 after 8,000 flight hours.

Surviving parts of cutting-edge Mach 2 prototype on display

Having received the remains of the partially assembled Hawker P.1121 from RAF Cosford in January, the Brooklands Museum has now displayed the nose section along with the other remaining parts.

The Hawker P.1121 was an advanced Mach 2 fighter project designed in the 1950s, which was halted following the 1957 defence paper issued by Duncan Sandys, advocating for guided missiles in the future. At the time, a prototype powered by a de Havilland Gyron turbojet was already under construction. The aircraft was designed by a team at Hawker Siddeley led by Sir Sydney Camm, the designer of the Hawker Hurricane.

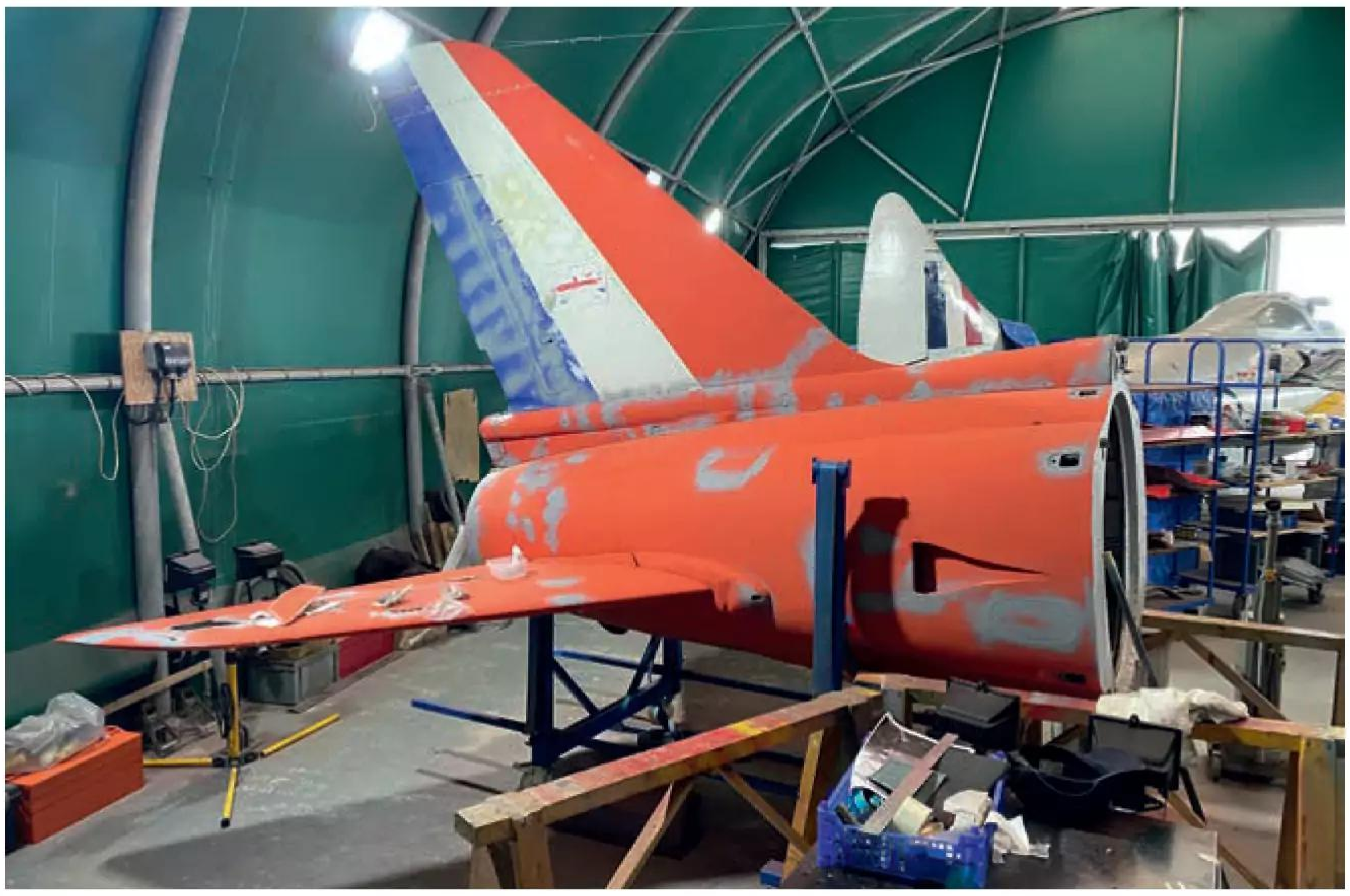

Despite its small size, Gnat XR571 has thoroughly 'tested' the team of engineering volunteers at the Tangmere Military Aviation Museum. It's pictured here in the restoration hangar.

Seeing red again at Tangmere with big effort for little trainer

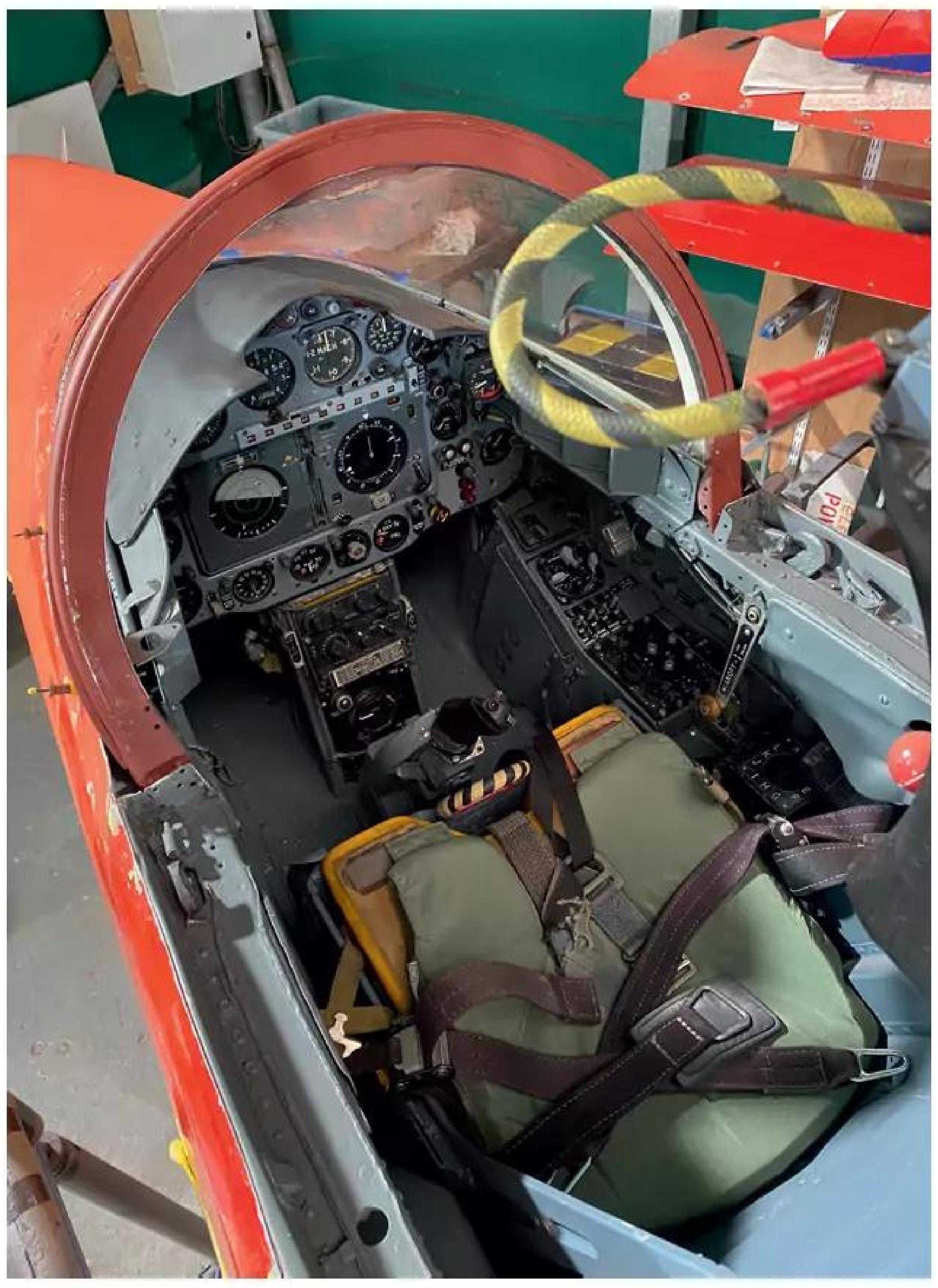
Among all those who flew it in the Royal Air Force during their fast-jet pilot training, the Folland Gnat was described as simply a 'sports car of the sky'. Its small size and exceptional performance left a lasting impression on everyone who mastered it and later flew frontline types like Lightnings, Phantoms, and Buccaneers. The small size of the training jet might suggest that restoring one to a static condition could be fairly straightforward, but the level of detail and care that the volunteer engineers at the Tangmere Military Aviation Museum are currently dedicating to one of their projects reveals some restoration challenges.

Tangmere's T.1 Gnat, XR571, first flew in 1963 and was assigned to No 4 Flying Training School (FTS) at RAF Valley in Anglesey, Wales, where it served for 12 years.

In 1975, XR571 experienced a heavy landing and was classified as a Category 5, making it beyond economical repair. It was allocated to RAF Brampton in Cambridgeshire, then home to HQ Support Command, where it served as a gate guardian, and the Gnat retained its original training scheme.


By removing the tail section, the extensive corrosion in this area could be addressed and replaced with new metal skin, which has been coated with protective paint.

In 1979, XR571 was relocated to RAF Kemble in Gloucestershire, then the base for the RAF Red Arrows. It was repainted in the aerobatic team's colours and resumed its role as gate guardian. A subsequent move to RAF Scampton, Lincolnshire, in 1983, with the display team, saw the Gnat remain outside for several years before being transferred to the Station Heritage Centre for refurbishment.

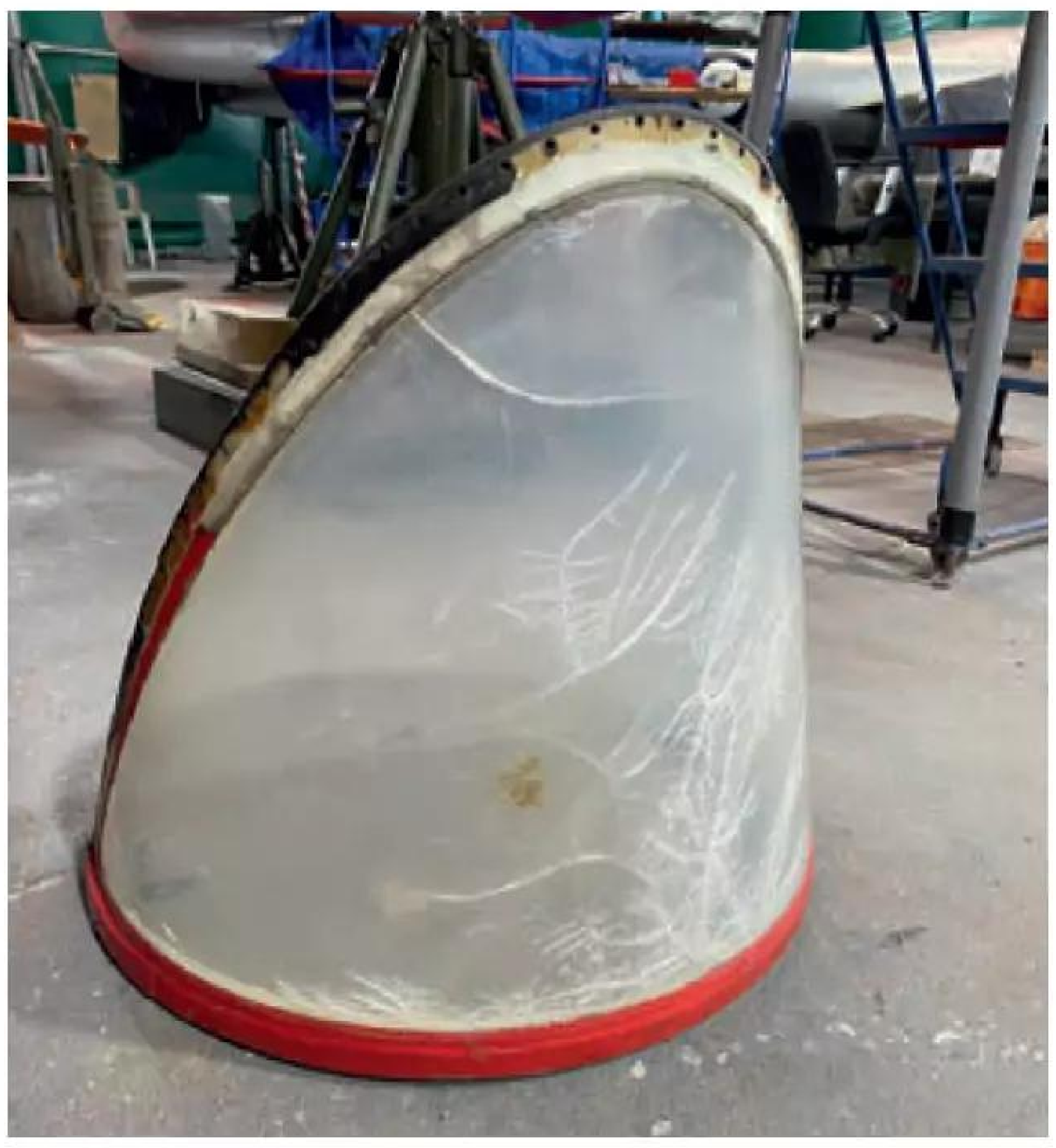


After eight months of work, the front cockpit of the Gnat is fully restored and complete, with only LED lighting left to install.

Cleaned, refurbished, and repainted the Gnat's undercarriage, which showed only slight damage from its heavy landing when in service with No 4 Flying Training School (FTS) at RAF Valley.

The closure of RAF Scampton in early 2023 led to XR571 being temporarily stored and auctioned online by the MOD in February. A successful bid from Tangmere resulted in the Gnat arriving at the museum on a low-loader in March. Initially displayed outside, some restoration work was carried out. The Gnat is now housed inside the museum's conservation hangar, undergoing extensive refurbishment by the museum's experienced volunteers, one of whom is Ray Hook.

"After we completed the restoration work on the Vampire T.11, we reorganised the restoration area and brought in the Gnat to begin dismantling it. We removed the wheels and undercarriage, took off the tail, which was badly corroded, and started treating all these areas. We've renovated the undercarriage and wheel bays, repainted these areas, and reattached the legs to the fuselage. We are currently rubbing down the fuselage before repainting, which we expect to do in the spring when the weather improves," said Ray.



The old front canopy was crazed and milky when the aircraft arrived at the museum. Volunteers have since replaced it with a clear one.

The Gnat's finished main undercarriage doors await attachment to the airframe next year.

John Nicholas, one of Tangmere's volunteer engineering staff and managing the Gnat project, explained to *Aviation Classics Monthly* about the extensive work needed on the tail section of XR571. "There had been a considerable amount of ballast placed at the back of the aircraft during its time as a gate guard, and the ballast absorbed water, which caused the lower skin of the fuselage to corrode heavily. It was a quite extensive repair process, involving reforming the rear frame, cutting out the corroded metal, and inserting a flush skin with internal doublers, as well as rolling an edge on the rear lip of the fuselage," Nicholas continues: "We removed all the flying surfaces, lightly scuffed them before painting, and reconditioned the flying control hinge points because they were in poor condition. However, we will not attach all of it to the cockpit controls. The surfaces will be held in position. When it comes to painting the Gnat, we'll do it in two halves because joining it together would make the tip of the tailplane too close to the tail of the Vampire when we apply the red. So, we'll paint the tail on the stand and join it once it's finished."

Asked what some of the biggest challenges with the Gnat had been, Cook adds: "The cockpit was like assembling a jigsaw puzzle. One person had taken it apart, and another was putting it back together without any communication between them. It's one of the issues with long restoration projects: maintaining continuity. We lost a bit of that in this area.

"The front cockpit is mostly finished; the back wasn't completed when we received it, so it will just be tidied up. In the front, I plan to install some red LEDs that will light up along with the navigation lights. Achieving this look has taken about eight months."

The front canopy windscreen has also been replaced because the original was badly crazed and cracked. What was expected to be a relatively simple job took engineering volunteer Kevin Jones about three weeks, he adds: "I had to drill out the screws securing the original in place because they were all rusty, broken, and being cam lock screws, which makes them difficult to remove.

"What we found with the new screen is that it wasn't an exact copy. I believe many of these Gnats were hand-built, so there was some variation in certain areas. But, once in place and sprayed, it will look the part."

RAF Cosford donated a complete Bristol Siddeley Orpheus engine, which was used in the Folland Gnat, to the museum. Once XR751 is restored, the engine will be displayed alongside the aircraft.

All images Glenn Sands

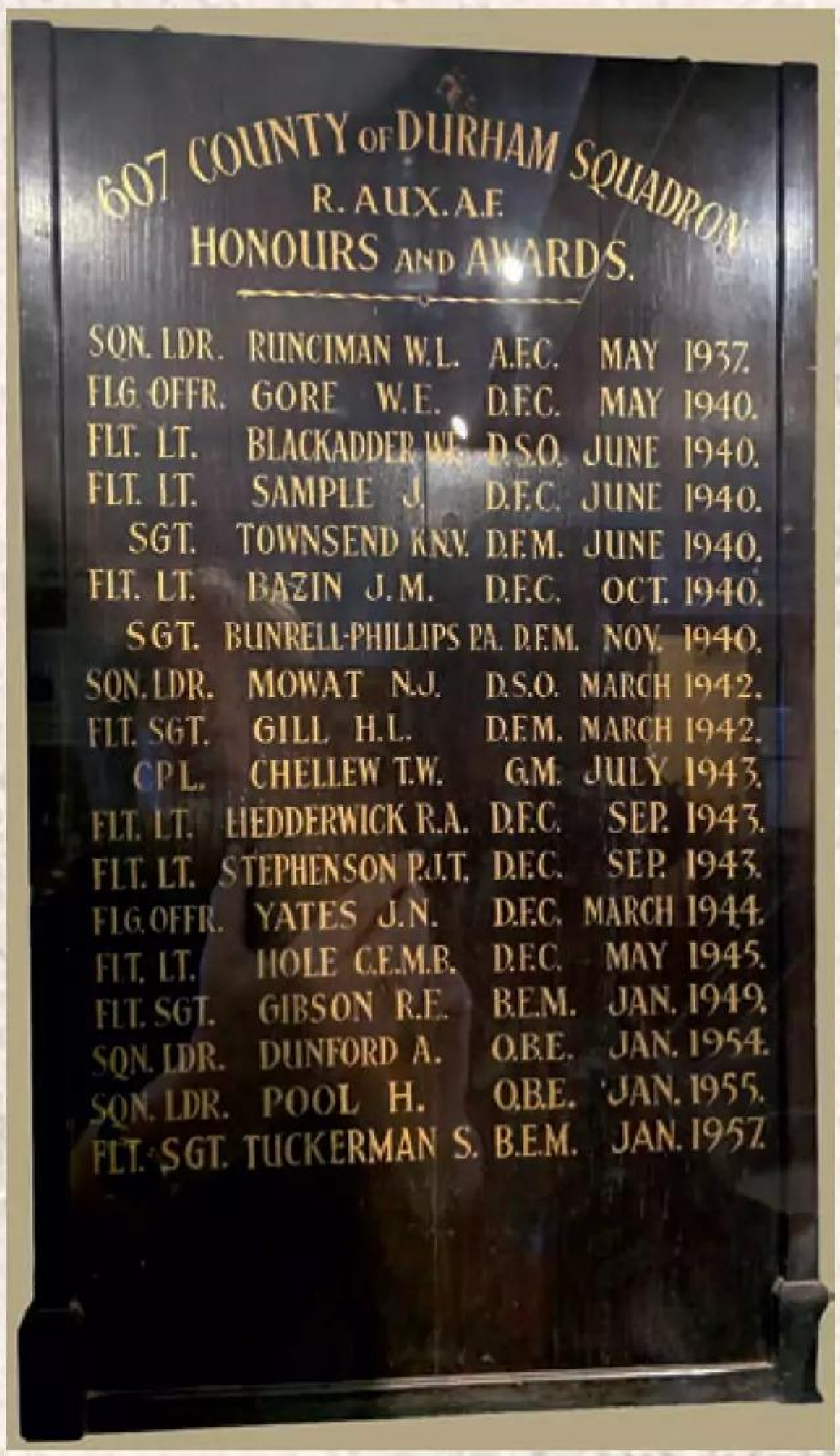
A replica Hurricane –

a tribute to 607 Squadron County of Durham

By **Mike** & **Julie Blenkinsop**

On leaving the bright sunshine and entering the dimly-lit corridor, you could miss the importance of the large carved wooden plaque which hangs just inside the door. In gold stencil, 18 names are apparent, all pilots from 607 Squadron County of Durham. Three lines down, one of the names on the roll of honour stands out, Flight Lieutenant W. F. Blackadder, who led the squadron at the beginning of the Second World War.

We have just entered the first of a group of hangars in the North East Land Sea and Air Museum (NELSAM) on the old Usworth airfield in Sunderland, on a site now shared with the giant Nissan car assembly plant, to meet retired engineer Stephen Corbett who used to be the manager of the museum in the 1980s; the museum has been in existence now for over 50 years.



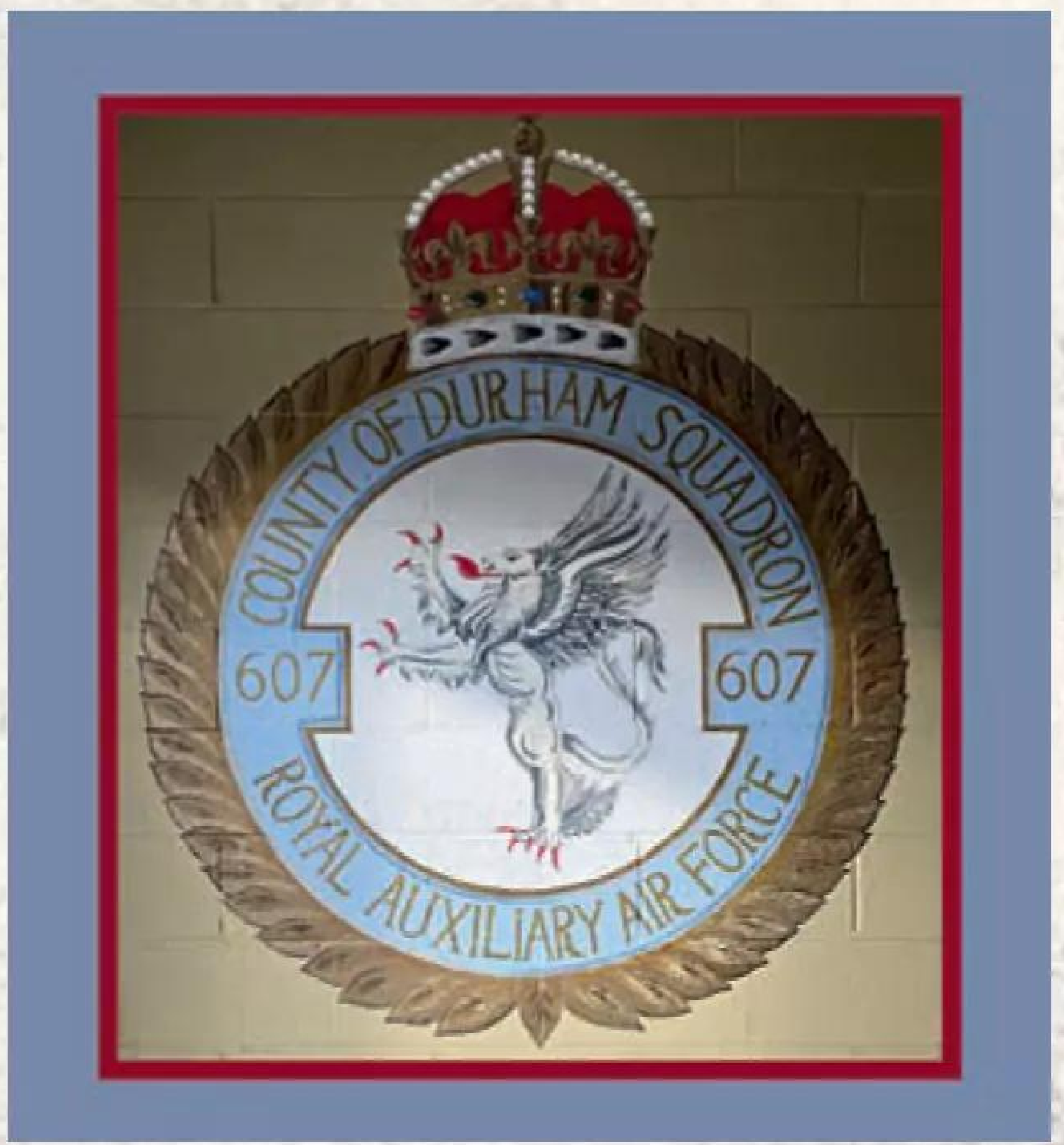
607 COUNTY OF DURHAM SQUADRON
R. AUX. A.F.
HONOURS AND AWARDS.

SQN. LDR.	RUNCIMAN W.L.	A.F.C.	MAY 1937.
FLG. OFFR.	GORE W.E.	D.F.C.	MAY 1940.
FLT. LT.	BLACKADDER W.F.	D.S.O.	JUNE 1940.
FLT. LT.	SAMPLE J.	D.F.C.	JUNE 1940.
SGT.	TOWNSEND K.N.V.	D.F.M.	JUNE 1940.
FLT. LT.	BAZIN J.M.	D.F.C.	OCT. 1940.
SGT.	BUNRELL-PHILLIPS P.A.	D.F.M.	NOV. 1940.
SQN. LDR.	MOWAT N.J.	D.S.O.	MARCH 1942.
FLT. SGT.	GILL H.L.	D.F.M.	MARCH 1942.
CPL.	CHELLEW T.W.	G.M.	JULY 1943.
FLT. LT.	HEDDERWICK R.A.	D.F.C.	SEP. 1943.
FLT. LT.	STEPHENSON P.J.T.	D.F.C.	SEP. 1943.
FLG. OFFR.	YATES J.N.	D.F.C.	MARCH 1944.
FLT. LT.	HOLE C.E.M.B.	D.F.C.	MAY 1945.
FLT. SGT.	GIBSON R.E.	B.E.M.	JAN. 1949.
SQN. LDR.	DUNFORD A.	O.B.E.	JAN. 1954.
SQN. LDR.	POOL H.	O.B.E.	JAN. 1955.
FLT. SGT.	TUCKERMAN S.	B.E.M.	JAN. 1957.

The roll call of 607 Squadron. Eighteen distinguished pilot's names at the entrance to the NELSAM museum.

607 Squadron had been ordered to France on 15 November 1939 at the beginning of the Battle of Britain, it returned in 1940 and at just 27 years old, Squadron Leader Flt Lt William Francis Blackadder was heading up the flight of Hurricanes. A large German force coming in from Norway was dissuaded from aggressive attack on the northeast industrial factories and military airfields by the actions of the fighters from the station with the assistance of the boys from RAF Drem in East Lothian and Acklington in Northumberland. Blackadder shot down, or heavily participated in, the destruction of three enemy aircraft, two recognised as a Heinkel He 111 and a Dornier 217 with fire from his Vickers and Browning machine guns and on another mission had run the gauntlet of enemy fire to bring back important infrastructure reconnaissance information on roads and bridges in France. His Distinguished Service Order citation appeared on 4 June 1940. It is this man who epitomises the roll of 607 County of Durham Squadron and who has inspired two dedicated enthusiasts to build a full-size replica of his Hurricane from scratch.

Working in the cold and gloom of the Nissen hangar, 18 months' work by Stephen Corbett and fellow engineer Dave Dellow has now created a recognisable shape. Stephen carries on the project singlehandedly now, as Dave's work commitments take him away from the project for a while. Stephen unfolds the story of their quest for original parts from the legendary plane.

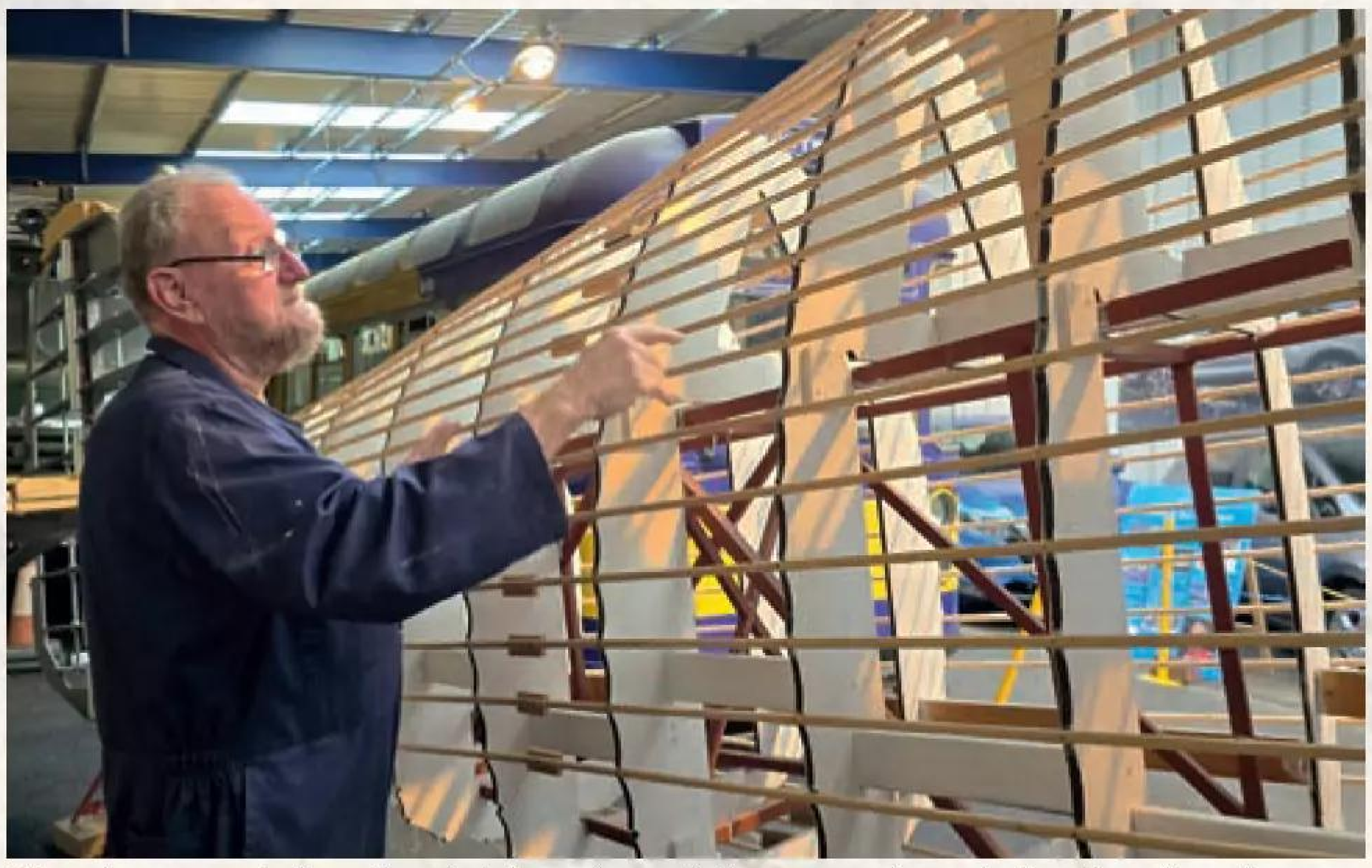


The 607 Squadron banner in the main hangar at NELSAM, Sunderland.

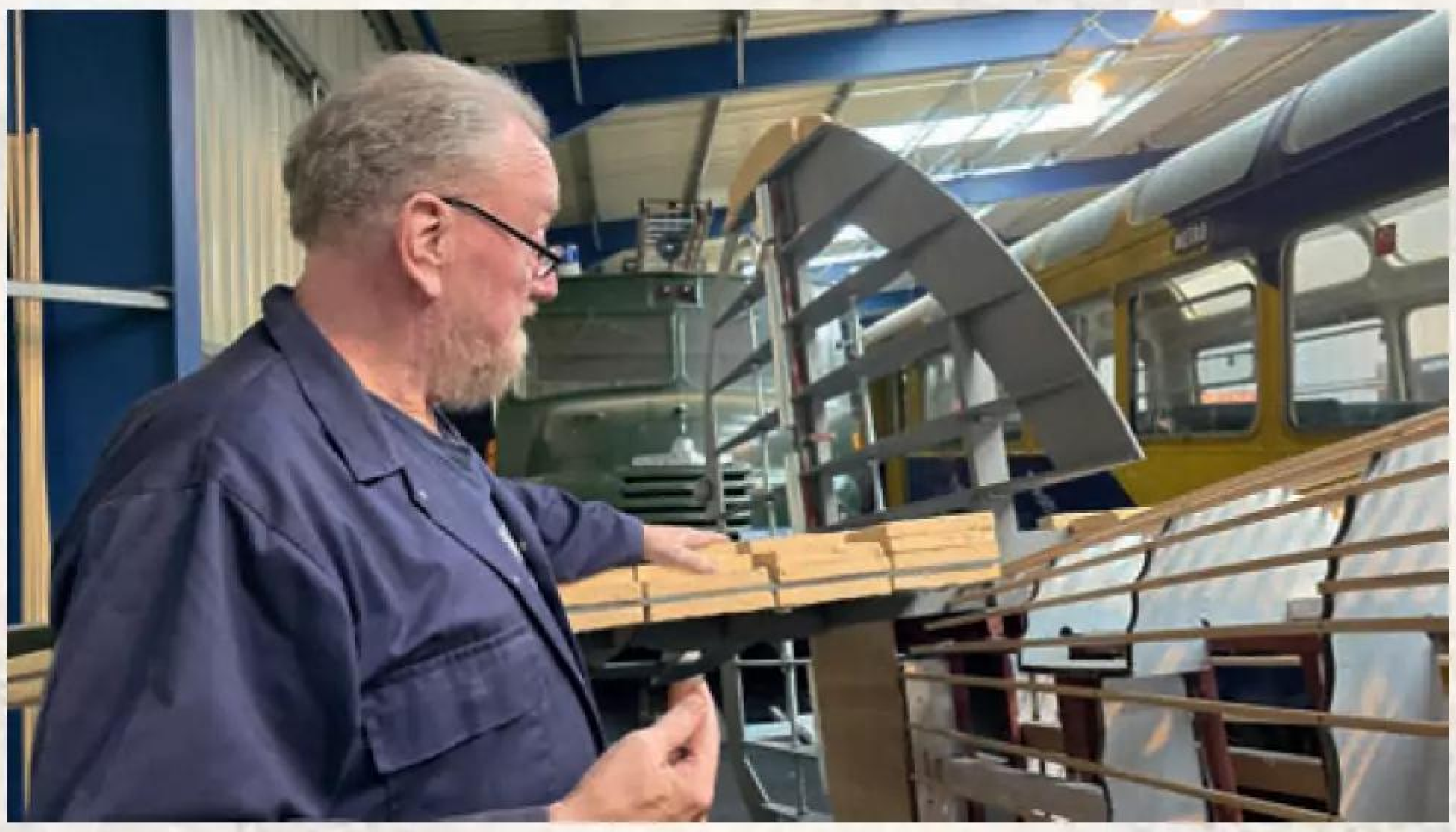
HURRICANE
P2874
Team Member
NORTH EAST

A rare set of P2874 club overalls worn by project manager Stephen Corbett.

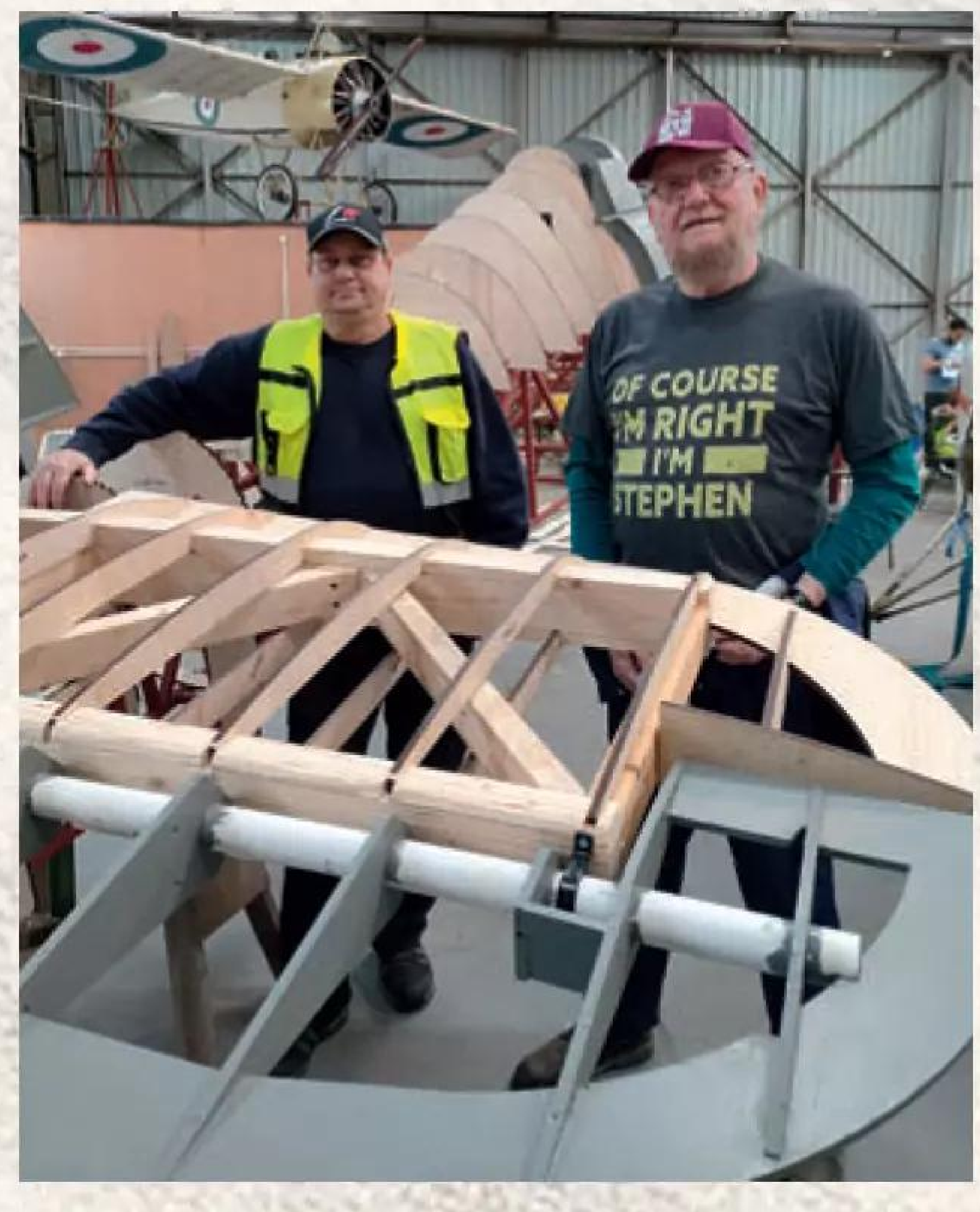
The basic structure came from a film set where a structural skeleton of a Hurricane had been stripped of all its feature bodywork and was a rolling conglomeration of angle iron. First thing to do was to create a set of



Stephen explains the intricacies of the woodwork for the fuselage.



The tailplane shape is fashioned by bulking out the woodwork frame with blocks of insulation.



Dave Dellow (left) built the tailplane while Stephen designed and built the elevators.

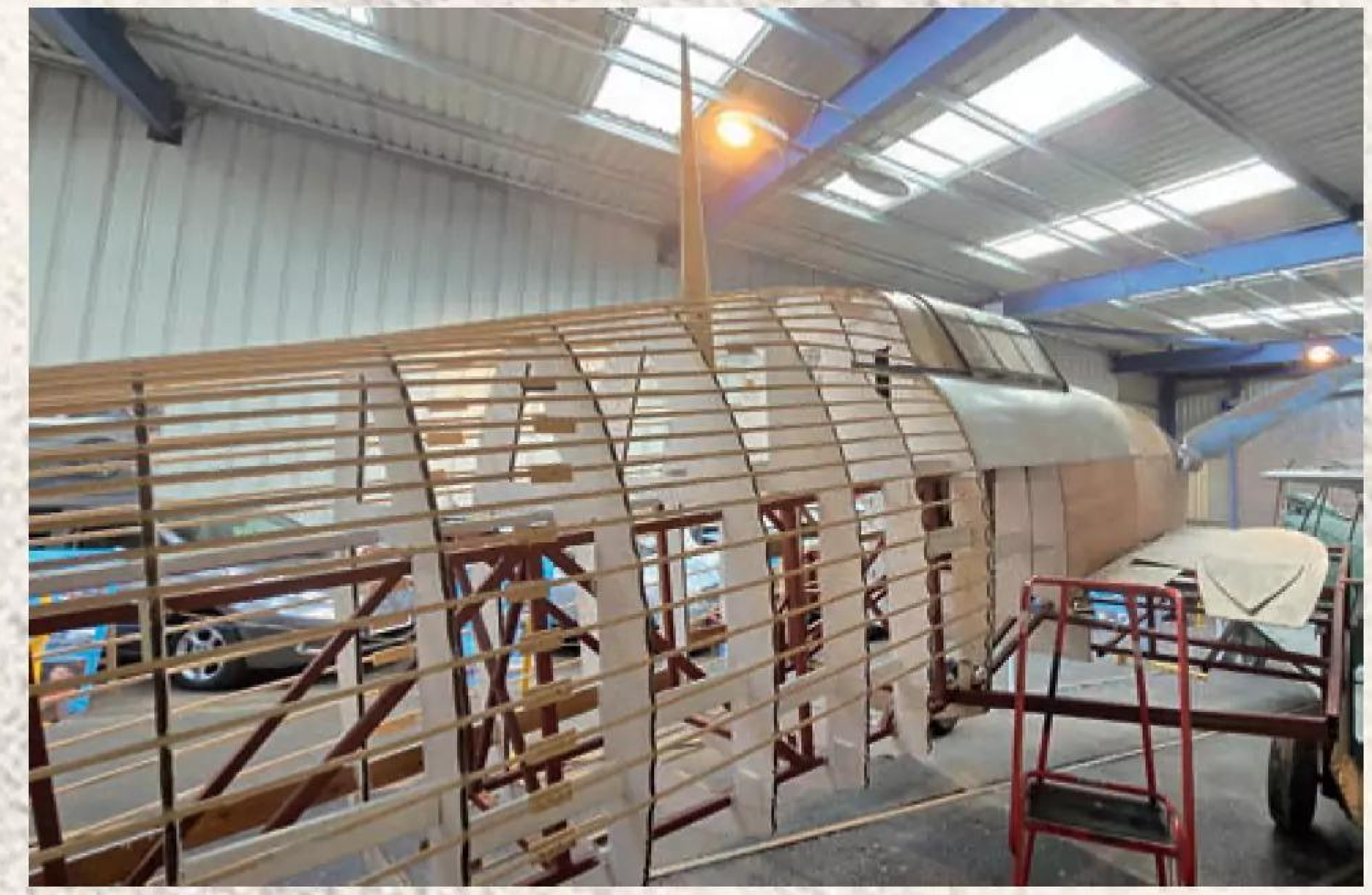
engineering drawings to work off. Usefully, Stephen has life-long experience as an engineering draughtsman, so has created a set of detailed technical drawings to build the replica onto the frame, but has also had the work of Arthur Bentley, a world acknowledged expert in aviation technical drawing, for reference too.

It has had its challenges as the basic recovered metal frame was unexpectedly bent out of alignment making it difficult to create a uniform wooden support structure. The fuselage is in a state of production with the main frame spars having been painstakingly assembled. The difficulty in this part of the construction is the design of each of the spars and their diminishing and exacting size as they move towards the tailplane. Fortunately, Stephen found a wood-cutting laser company which could perform the complex tasks accurately, cutting the templates from his skilfully-drawn plans which had to include the scallop notches required to support the stringers running the length of the fuselage. In the real plane they transfer stresses off the aircraft skin onto the strength of the body, while the covering of Irish white linen (too expensive today) would have been doped and stretched over the frame to give a smooth air flow. For this project the Hurricane will have no wings as such, the construction will end at the fuselage roots where they would bolt onto the mainframe, due to space considerations. However, Stephen will be giving the root the facility to add wings in the future if space allows, by the placing of a socket/blanking plug at the join. Blackadder's Hurricane was an early Mark 1 which would have had fabric-covered wings, but the next generation had wings made of metal.

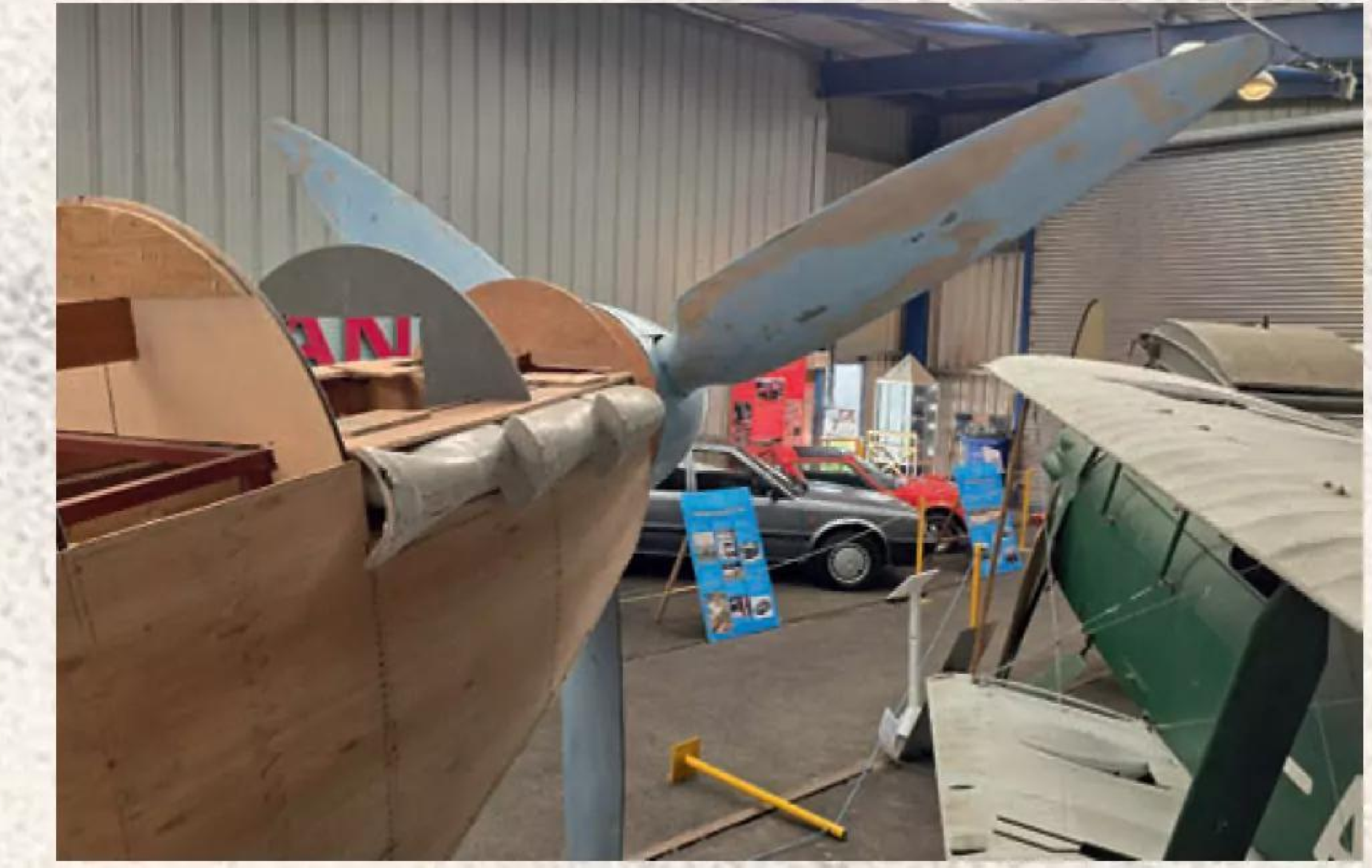
Stephen didn't have any metal-cutting equipment, so had to find alternatives using fibreglass and used some of his 3D creation skills in building the windscreen frame and the navigation lamp on the tailplane. The tail wheel came from a local crash site but had spent its life being the rolling force on a wheelbarrow until rescued from a neighbouring allotment at the village of Boldon, only a few hundred yards from the end of the Usworth runway.

The Hurricane canopy is one of the most fascinating parts of the project. Where would you find an original Hawker canopy when the Battle of Britain happened in 1940? On a farm in Alnwick is the answer, as the canopies actually make an excellent cloche for growing your vegetables.

Acklington was an RAF base to the north near to the county town of Alnwick, and once home to the Spitfires and Hurricanes of 72 and 49 Squadrons during the war and



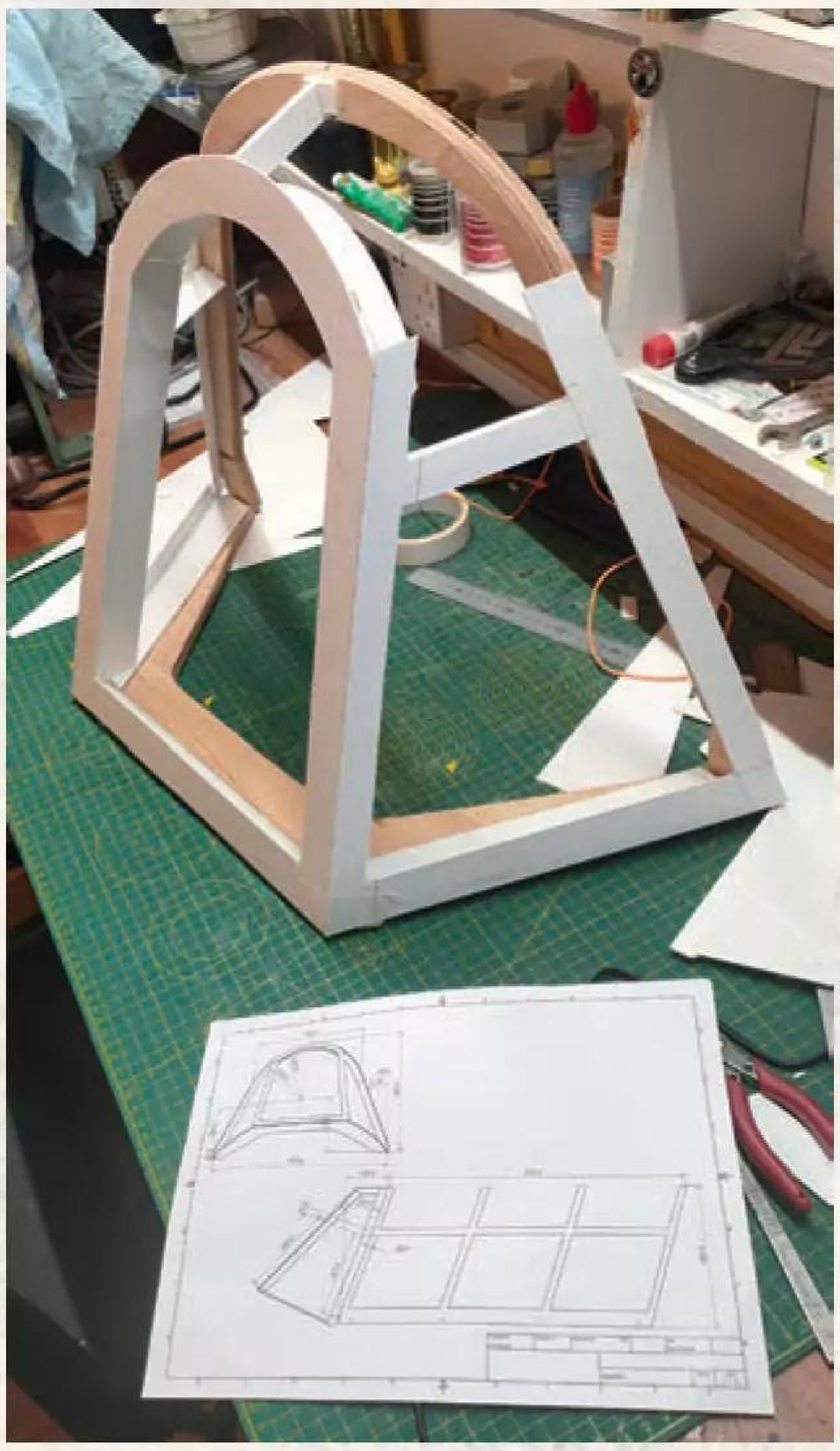
The Hurricane looks skeletal currently, although most of the formers are in place.



The plywood formers for the cowl are set up along with the false exhaust.

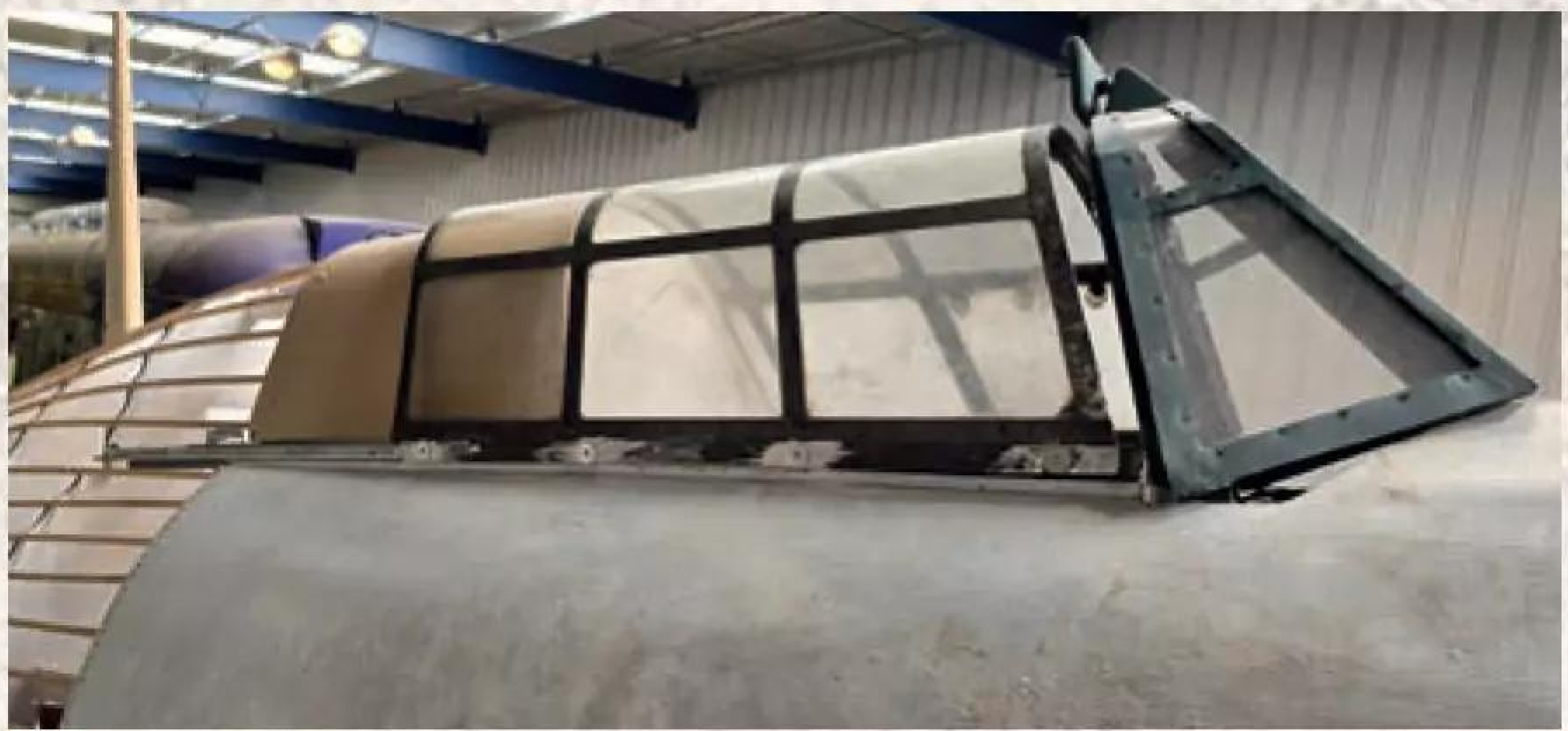
Mechanics servicing the engine of a Hawker Hurricane Mark I of N° 501 Squadron RAF at N° 1 Repair Centre, Reims-Champagne. *Image: IWM C1731*

An original WW2 image of RAF trainee airframe fitters working on an instructional Hurricane airframe in a Training Command Centre maintenance unit 'somewhere in England'. *Image: Mr B. J. Daventry RAF official photographer C851 IWM Public Domain*

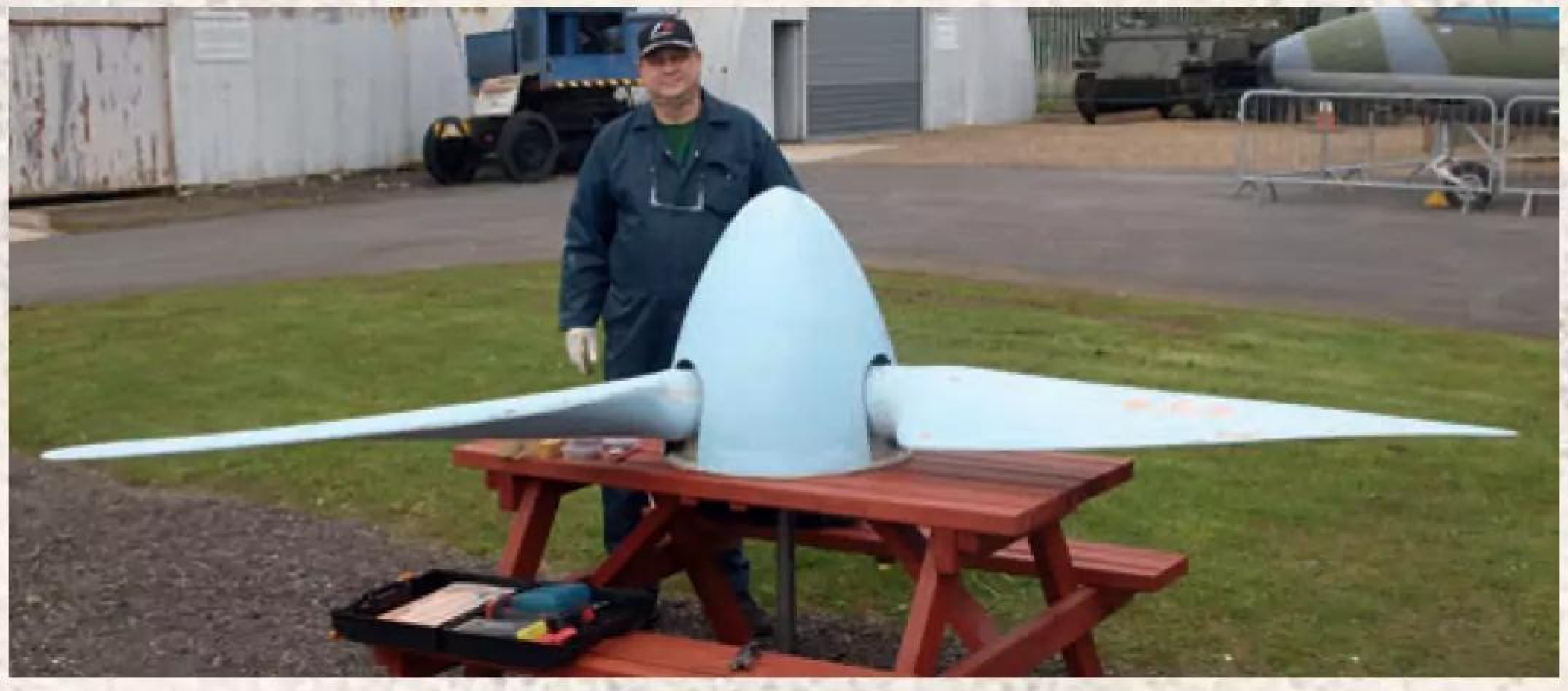


Stephen created the shape of the windscreen using 3D Digital printing technology.

latterly to 202 Air Sea Rescue Squadron. When the Acklington RAF base closed there was an auction sale of bits and pieces. Some of those bits, twelve exactly, happened to be replacement Hawker Hurricane canopies. A well-known local aviation enthusiast, Derek Walton, spotted a canopy in an allotment and asked the owner if he knew what it was. Confirming that he did, Derek asked if he could have it for the museum. Whether tongue-in-cheek or not, the owner said, "get me a greenhouse and you can have it, oh and you can have the other three as well; there were 12 of them, but kids smashed the others". A deal was about to be done so the 'boys' went to their local B&Q DIY store and bought a £79 greenhouse kit, took it round, erected it and swapped it for the four undamaged canopies. Everybody



One of the original Hurricane canopies placed for guiding the shape of the fuselage. Stephen has used one of the less perfect canopies retaining the first class one for the finished plane.



Dave Dellow with the new propeller, built in fibreglass by a specialist manufacturer, which also supplies replicas to the RAF.

Hurricanes had different propellers in their life, two blade and three blade.

was happy... In the same sale, the owner had acquired some Perspex B-25 Mitchell bomber top turret domes and a selection of astrodomes off the Avro York!

The 'worst' of the four canopies now sits on the top of the Hurricane for lining-up purposes as the plane has achieved a state of recognition with the front bodywork now resembling the iconic fighter.

The replica is going to be fashioned as P2874 coded AF*F as flown by Flt Lt W. F. Blackadder DSO in 1940, one of 500 built by the Gloster company to Hawker's design and in the squadron colours of the period. 14,583 Hawker Hurricanes were built in total.

Francis Blackadder rose to wing commander rank and was given a military OBE in 1945 and although working in many different locations during the war, he returned to Usworth and 607 Squadron toward the end of hostilities. Back on civvy street, he went on to work as a director of Moor Line Shipping Company until 27 November 1997, when he died at the age of 84 in Darlington. We believe his family still live in the Sunderland area.

Stephen begins to give us a guided tour around the full-size Hurricane replica. The work has taken 18 months so far and he thinks that another similar time period will see it finished. The plywood covering is taking shape and a recognisable Hurricane is appearing.

A dedicated man, Stephen Corbett, one time manager of the Sunderland museum shows some of the many drawings of the Hurricane which he and Dave Dellow have been working from to build the replica Hurricane.

To highlight the difficulties, our attention is drawn to the rear of the plane where Stephen and Dave cooperated, with Dave making the tailplane while Stephen built the elevators. Here lay a different issue, after initial construction in wood, the surfaces have been packed with blocks of insulation, which are glued into place, then fashioned to the correct form of the tailplane section. Once the average height and width is established, the foam will be shaped into the correct profile with a power sander, glued and finally covered in canvas cloth. Dense house insulation blocks must be used as the resin glue used in the fibreglass and cloth covering would literally melt other types of insulation.

The Hurricane is housed in one of the Nissen hangars with limited room around it, being squeezed between an example of the first aeroplane to fly into Usworth, a Gypsy Moth DH60, a Fleetwood single-decker tram and an AFS Green Goddess self-propelled pump.

The pilot who inspired the replica build, Flt. Lt William Francis Blackadder DSO. (and later OBE) who led the squadron in 1940.

The first portion of the plane now actually looks like a Hurricane with plates of plywood flapping around uneasily, ready to fit into place once the next piece has been manufactured to create the perfect shape. The outline of the Hurricane's cowl/bonnet is the next major headache as it will prove difficult making a rolling curve out of wood; a fibreglass alternative may have to be found. The three-blade prop was fabricated by a specialist company in fibreglass, which build replicas for the RAF too.

When P2874 is finished, it will be a fitting tribute to the young brave pilots of 607 Squadron, who, when scrambled on 15 August 1940, went out with 14, 72 and 79 Squadrons to meet a fighter-escorted wave of 150 Heinkel He 111 bombers at 14,000 feet, intent on destroying military and industrial targets of northeast England.

It is believed that eight bombers and seven Messerschmitt Bf 110 fighters were shot down and no significant damage was done to military targets.

We will follow Stephen's Hurricane project with interest. Watch this space. Sincere thanks to Stephen Corbett for his invaluable help. ■

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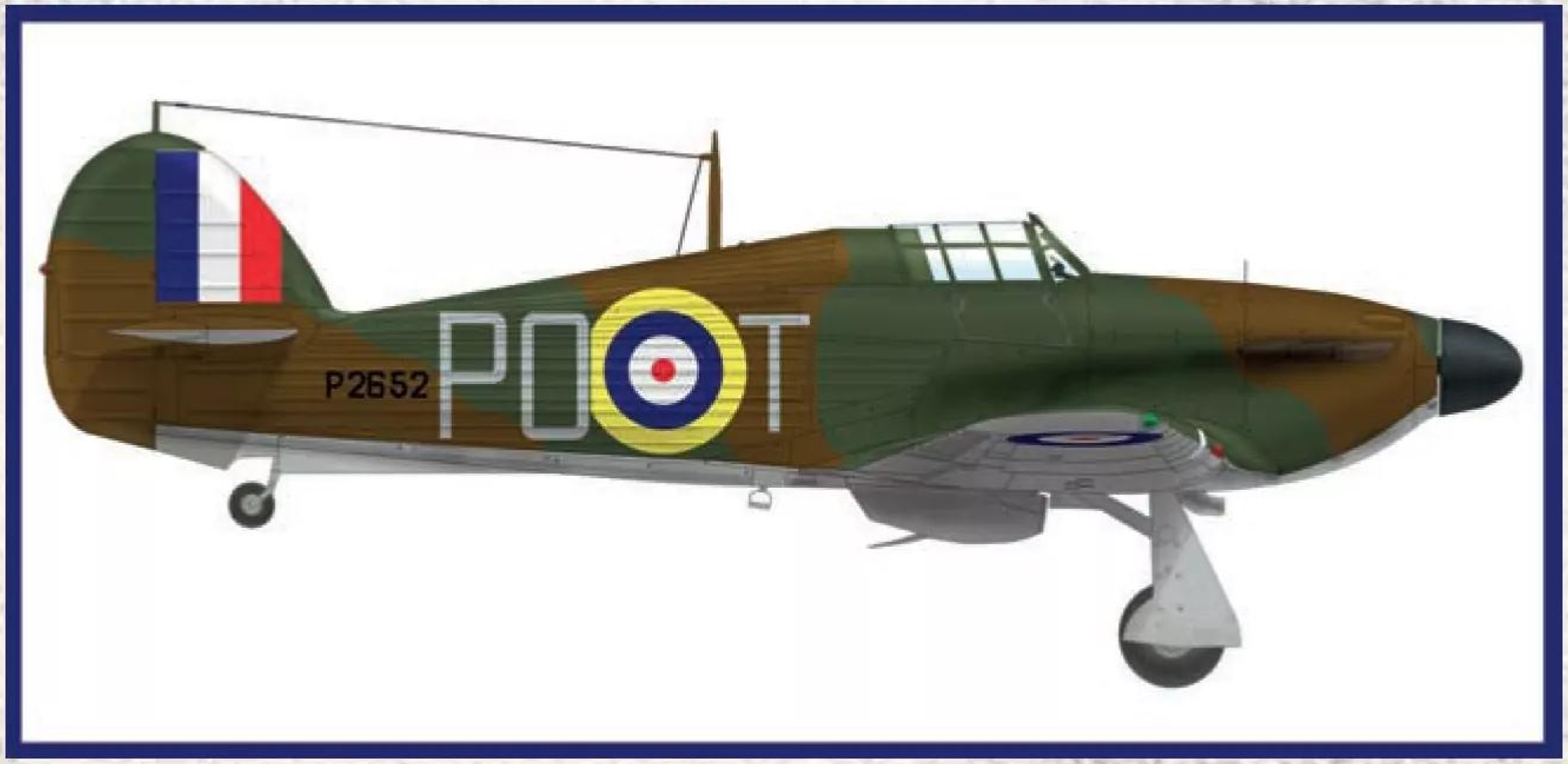

A Hawker Hurricane Mark I artwork. *Image: Martin Cizek wiki cc-by-sa 4.0*

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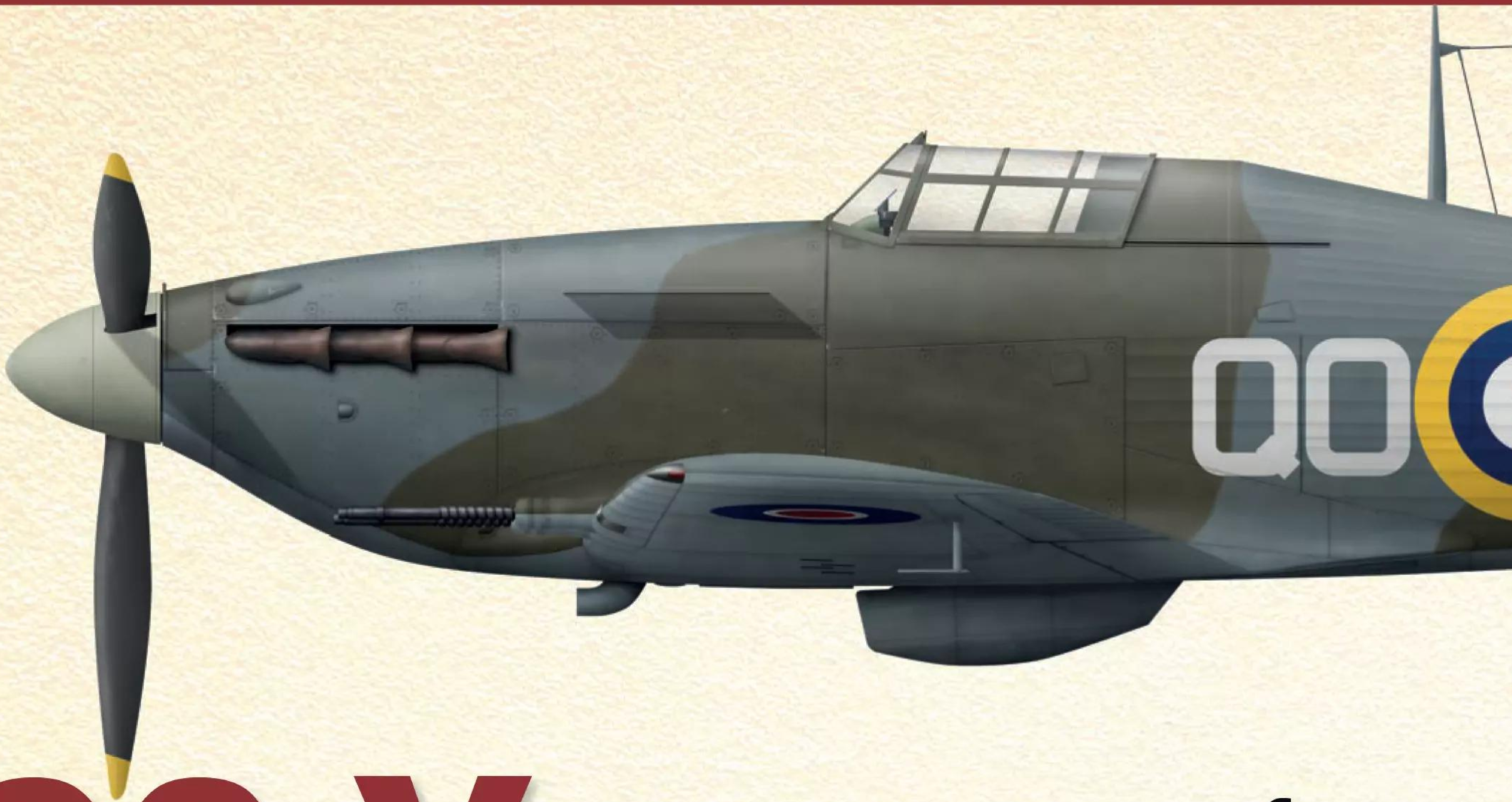

90 Years of the Hawker Hurricane

It has been 90 years since the first flight of the Hawker Hurricane, but where did the famous fighter come from? Chris Sandham-Bailey examines the design's lineage, development and variants...

Many late-1930s monoplanes, including the Bf 109 and the Spitfire, represented entirely new designs. In contrast, the Hurricane exemplifies the evolutionary transition between the robust structures found in biplanes and the more aerodynamic designs that were to dominate the war years.

Unlike the Hurricane's peers which were new designs, the Hurricane was only one stage in the evolution of the Hawker design that can be traced back to the Hawker Hart and culminated with the Hawker Sea Fury. The Hurricane was a safe design that was based on well-known technology so while it may not have been as advanced as the Spitfire it was reliable and had a reputation for taking heavy damage but still getting the pilot home safely. Having played a vital role during the Battle of Britain it went on to serve in all theatres throughout the war and in a range of secondary roles.

During the early 1930s, the Hawker Fury formed the backbone of fighter defence for the RAF and at the time was a formidable aircraft. However, it was becoming increasingly apparent to many including Hawker's chief designer Sydney Camm that biplanes would soon be eclipsed by monoplanes.

Already responsible for the Hart, Camm responded to Specification F7/30 with yet another variation of the Hart design fitted with the Goshawk engine, the Hawker P.V.3. Following the rejection of the P.V.3 he then considered adapting the design for a monoplane, a concept he had been toying with as early as 1933 before the P.V.3 had first flown but not developed due to the continued preference for biplanes by the Air Ministry.

Work went forward privately within Hawker on the Hart monoplane (as it was then known) during 1934 and it was proposed to use the Rolls-Royce PV.XII engine which was in development and would become the Merlin. Following talks with the Air Ministry, Hawker was allowed to submit the design for Specification F5/34. The specification called for eight guns to be carried and Camm considered the outer wing to be the most logical location for these, as it allowed easier access to armourers and would not require an interrupter to fire through the propeller.

A reluctance to jeopardise the project with radical features meant many aspects of the earlier designs were retained. The design continued the tradition of having a tubular fuselage which along with the outer wings was covered in canvas. This had the additional benefit of allowing cannon shells to pass through unimpeded and the repairs were very simple. The Air Ministry was concerned about the strength of the wings with all the guns firing, so in line with other designs the wings were replaced with a new all-metal single-plane design.

Along with the single wing there were two other significant differences that the new design introduced: The first was the addition of a retractable undercarriage; unlike its contemporaries the Bf 109 and Spitfire, the Hurricane's retracted inwards, creating a wide wheelbase and making it much more stable during taxiing and avoiding the accidents on rough terrain that the Spitfire and Bf 109 suffered. The second was

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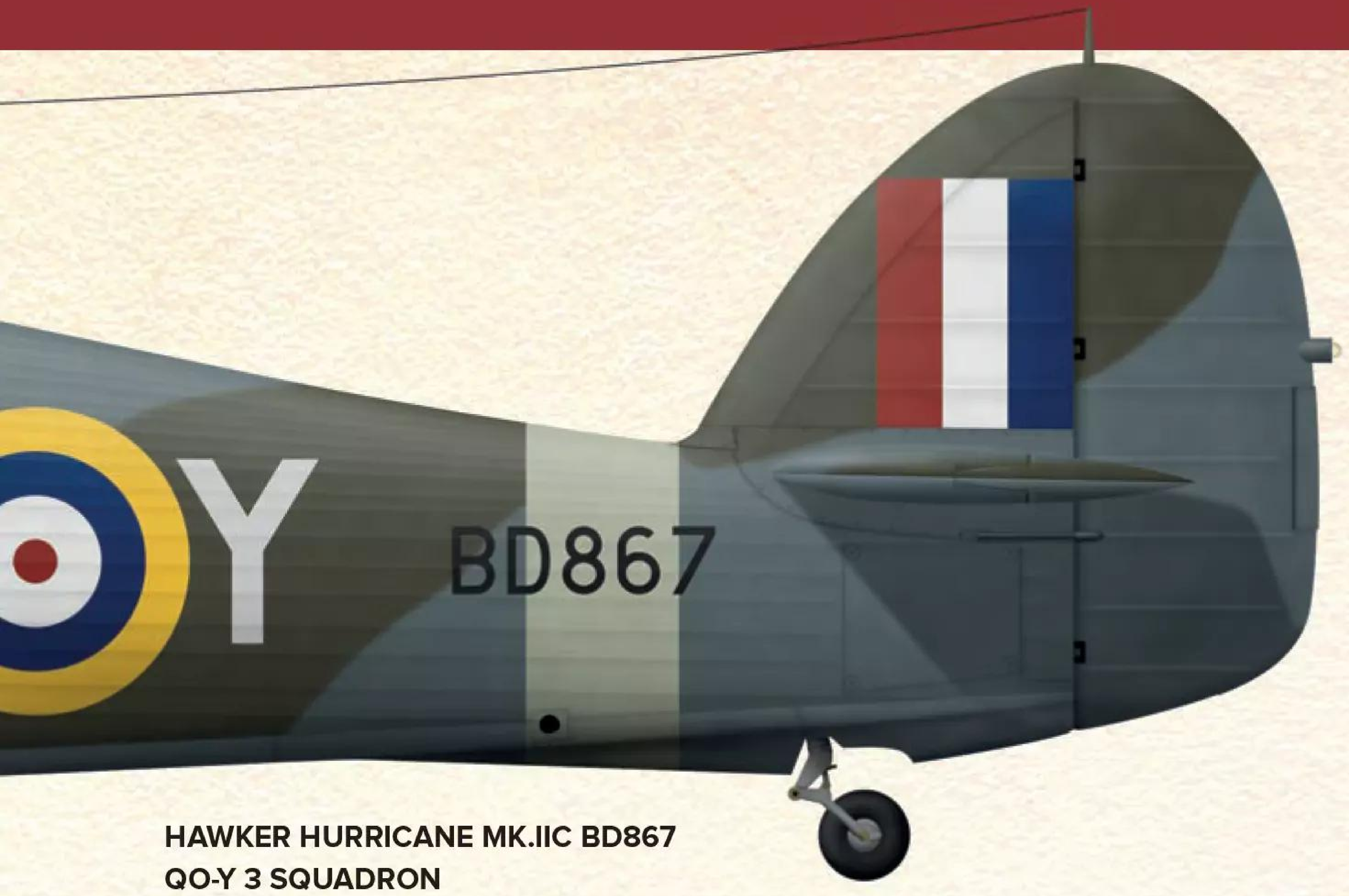
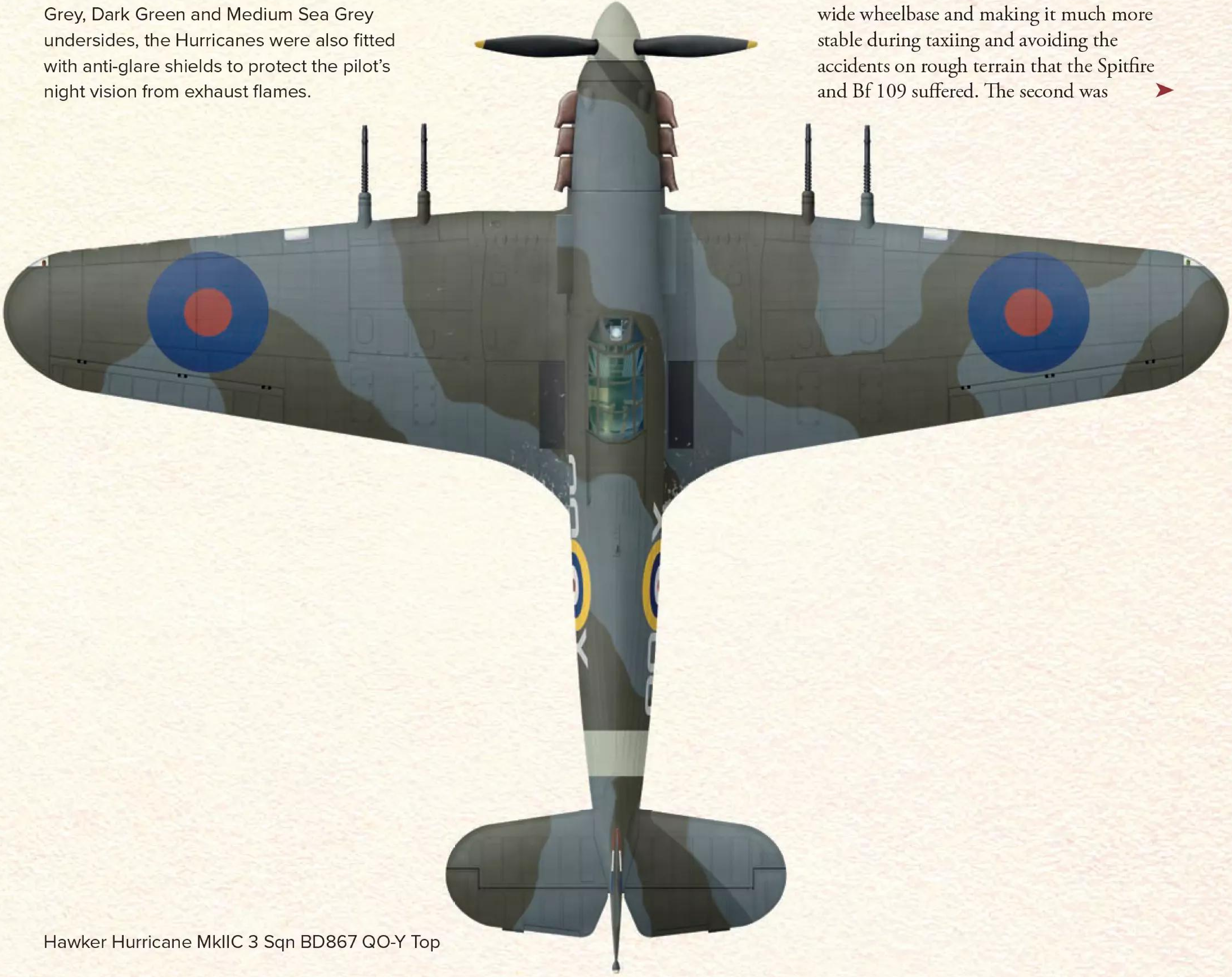
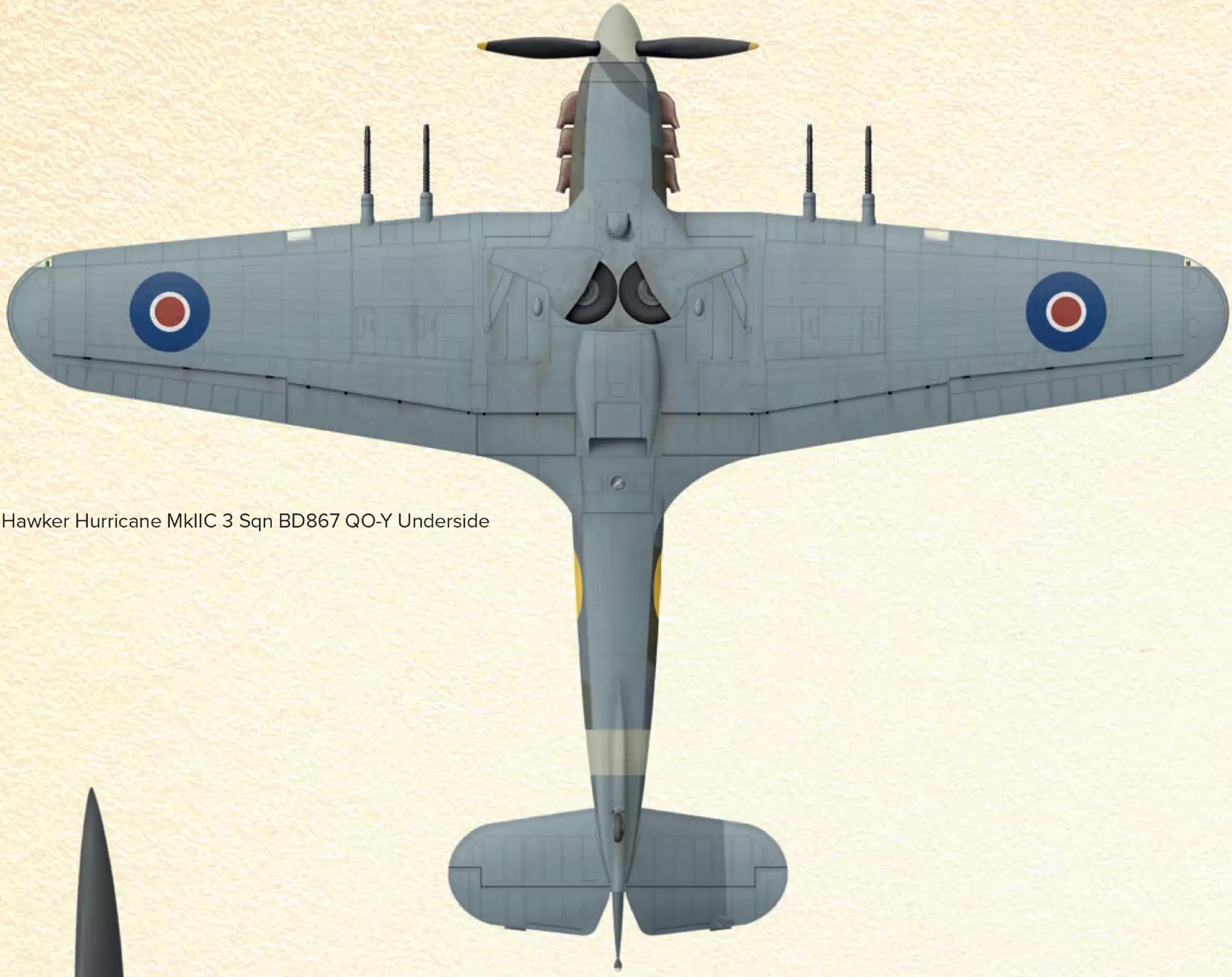


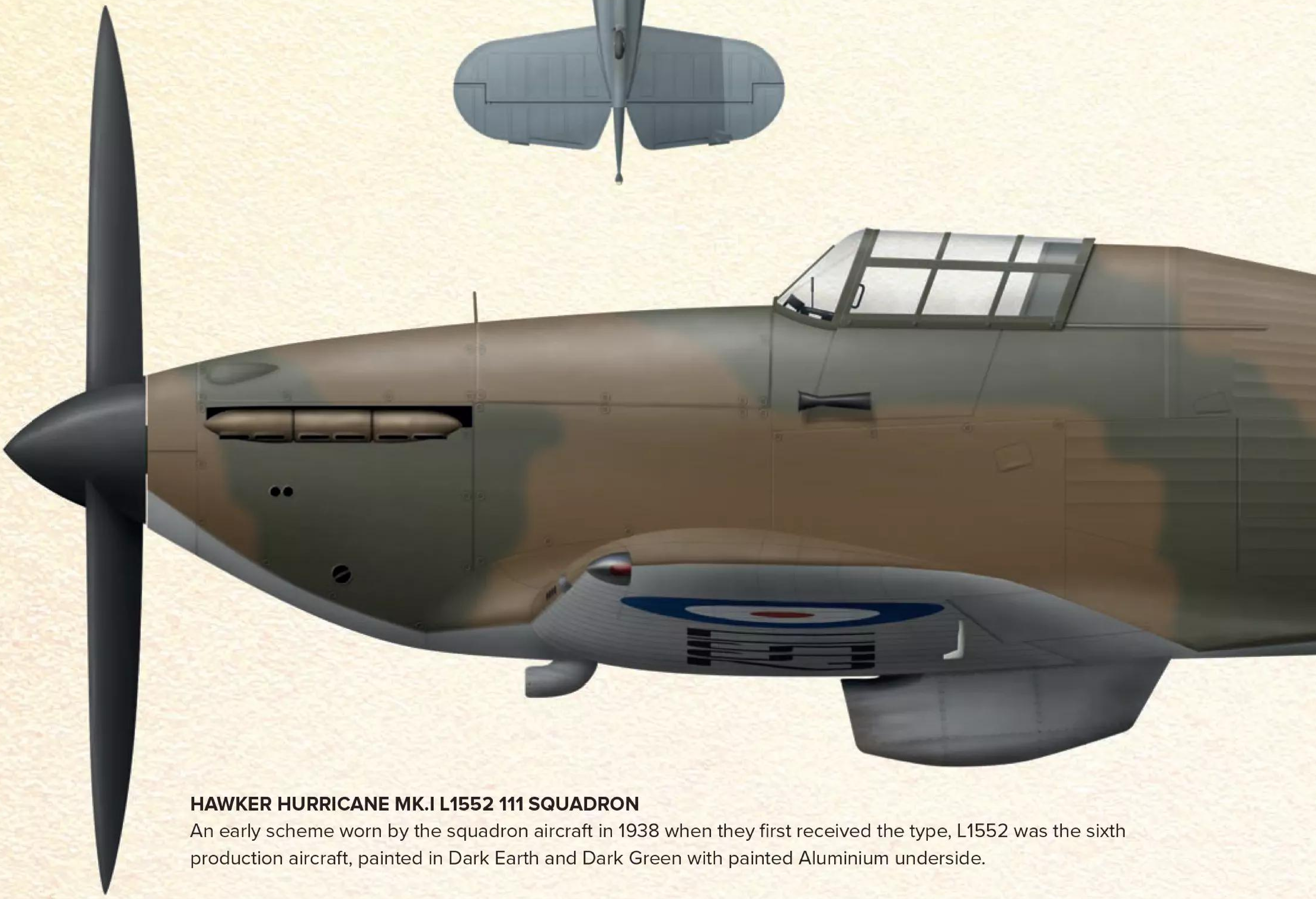
HAWKER HURRICANE MK.IIC BD867 QO-Y 3 SQUADRON
During April 1941 the squadron became a Night Fighter unit, replacing the Hurricane Mk.I with the Mk.IIB and Mk.IIC, aircraft were painted in a variation of Ocean Grey, Dark Green and Medium Sea Grey undersides, the Hurricanes were also fitted with anti-glare shields to protect the pilot's night vision from exhaust flames.



Hawker Hurricane MkIIC 3 Sqn BD867 QO-Y Top

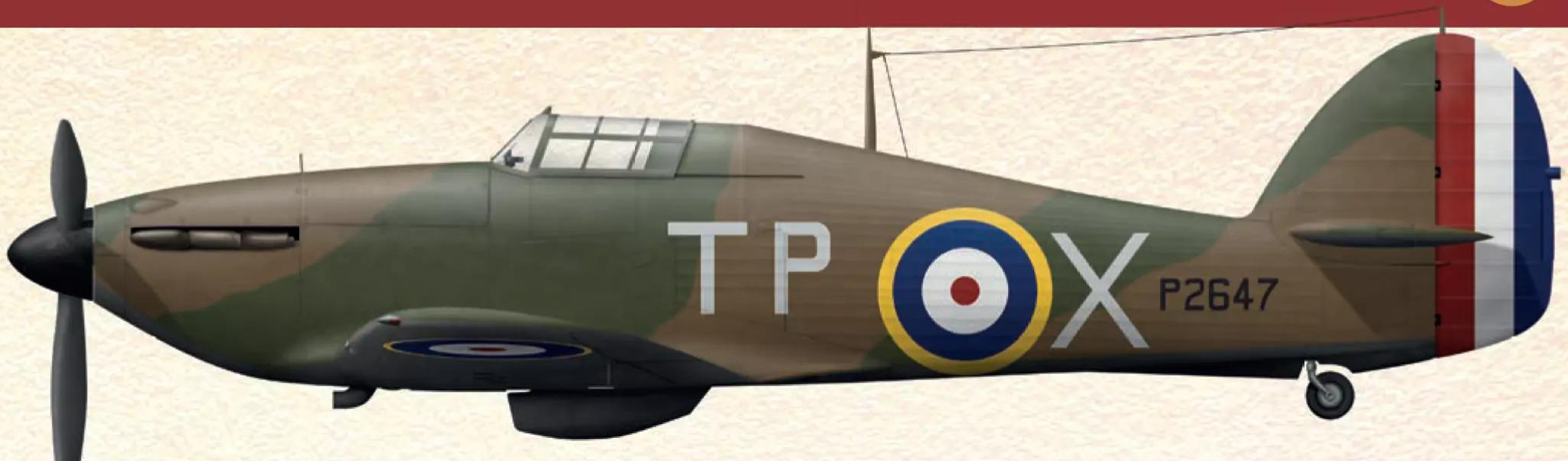


Hawker Hurricane MkIIC 3 Sqn BD867 QO-Y Underside

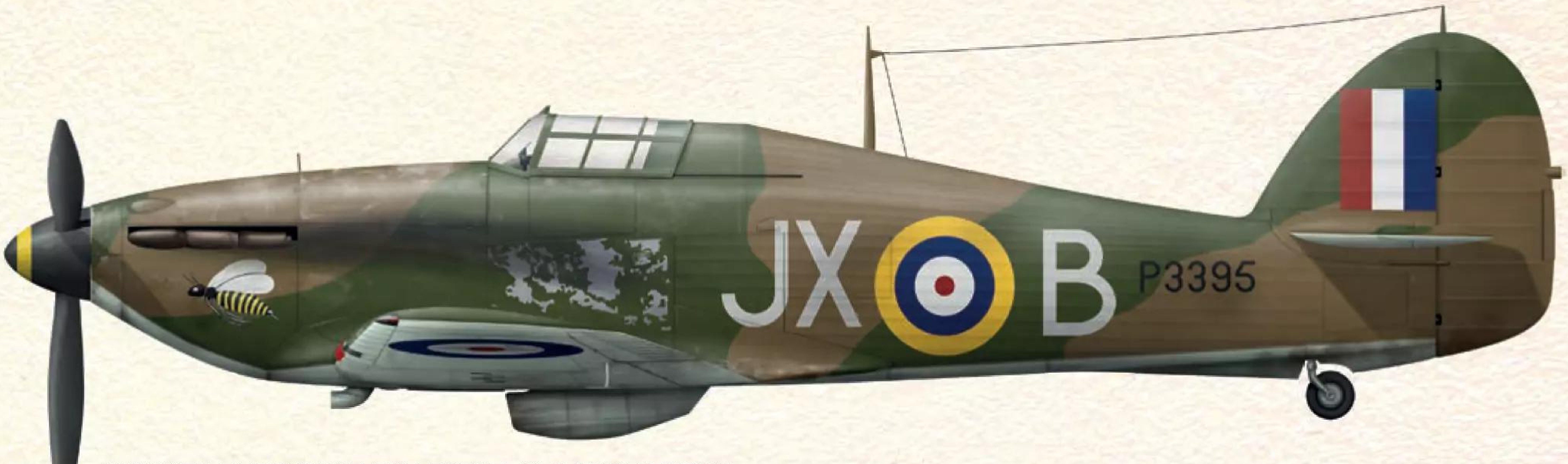


HAWKER HURRICANE MK.I L1552 111 SQUADRON

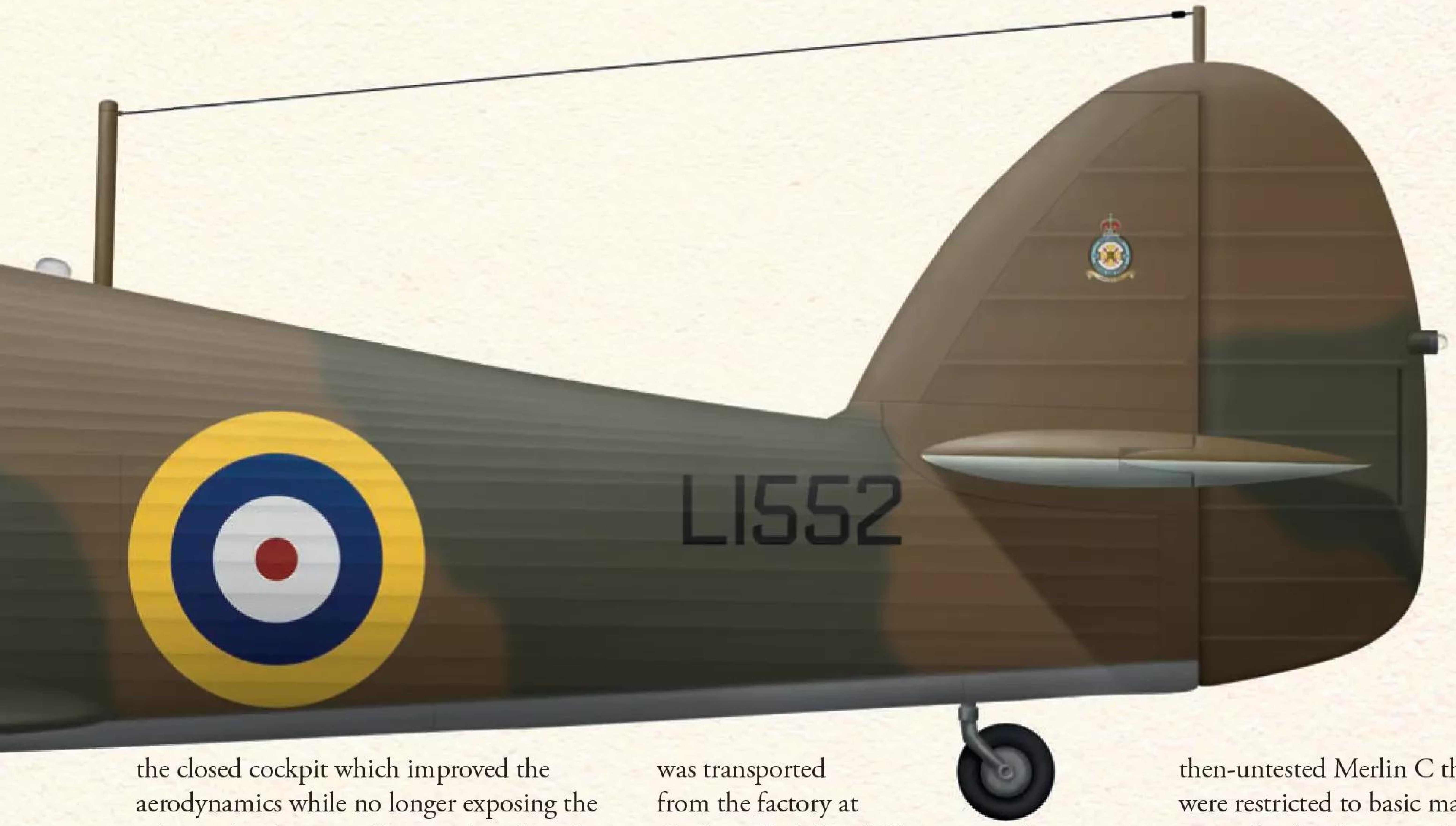
An early scheme worn by the squadron aircraft in 1938 when they first received the type, L1552 was the sixth production aircraft, painted in Dark Earth and Dark Green with painted Aluminium underside.



HAWKER HURRICANE MK.I P2647 TP-X 73 SQUADRON
While in France as part of the BEF, P2647 was involved in a ground collision with another aircraft and heavily damaged. Despite the tail and canopy being destroyed it was rebuilt and returned to action. Painted in Dark Earth and Dark Green with Night underside.



HAWKER HURRICANE MK.I P3395 JX-B 1 SQUADRON
The personal aircraft of the ace Sgt Plt Arthur Clowes, who was heavily involved in the Battle of Britain. It has a yellow band on the nose and a wasp on both sides of the nose. The wasp and code have since been worn by a Harrier and Typhoon.



the closed cockpit which improved the aerodynamics while no longer exposing the pilot to the elements. Despite these benefits there would be a litany of complaints from fighter pilots as they transitioned from the open cockpits they had been long used to.

Work on the prototype, K5083, was completed in October 1935 and the aircraft was transported from the factory at Canbury Park Road, Kingston, a short distance to Brooklands for final assembly and on November 6, the maiden flight, with company chief test pilot Flt Lt P. W. S. 'George' Bulman at the controls. As the prototype was fitted with the latest and then-untested Merlin C the first few flights were restricted to basic manoeuvres and it was only after four months that the aircraft was delivered to the RAF at Martlesham Heath for service trials.

The Hurricane was impressive compared to the fighters then in service. At 16,200ft, K5083 produced a top speed of

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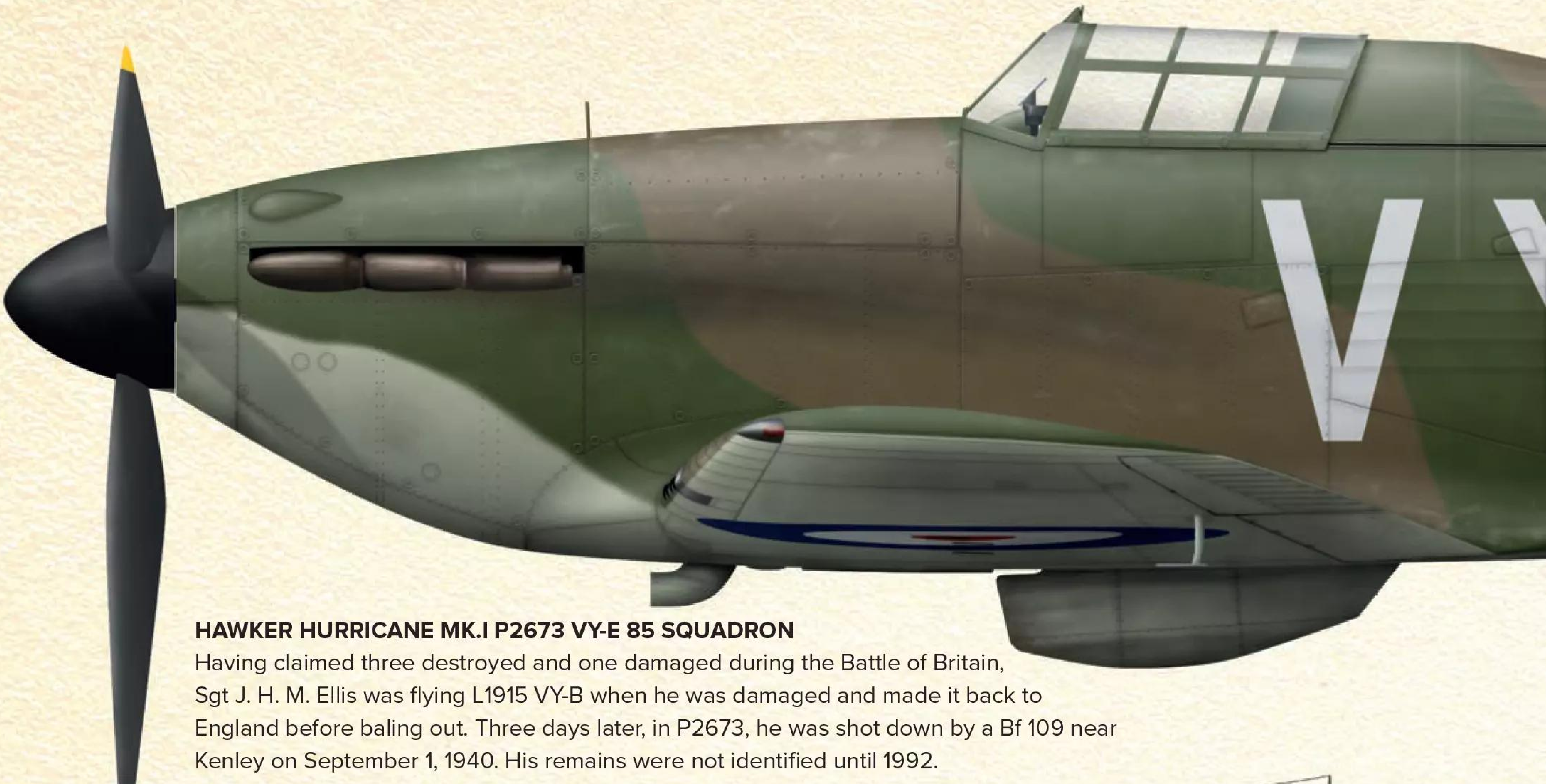
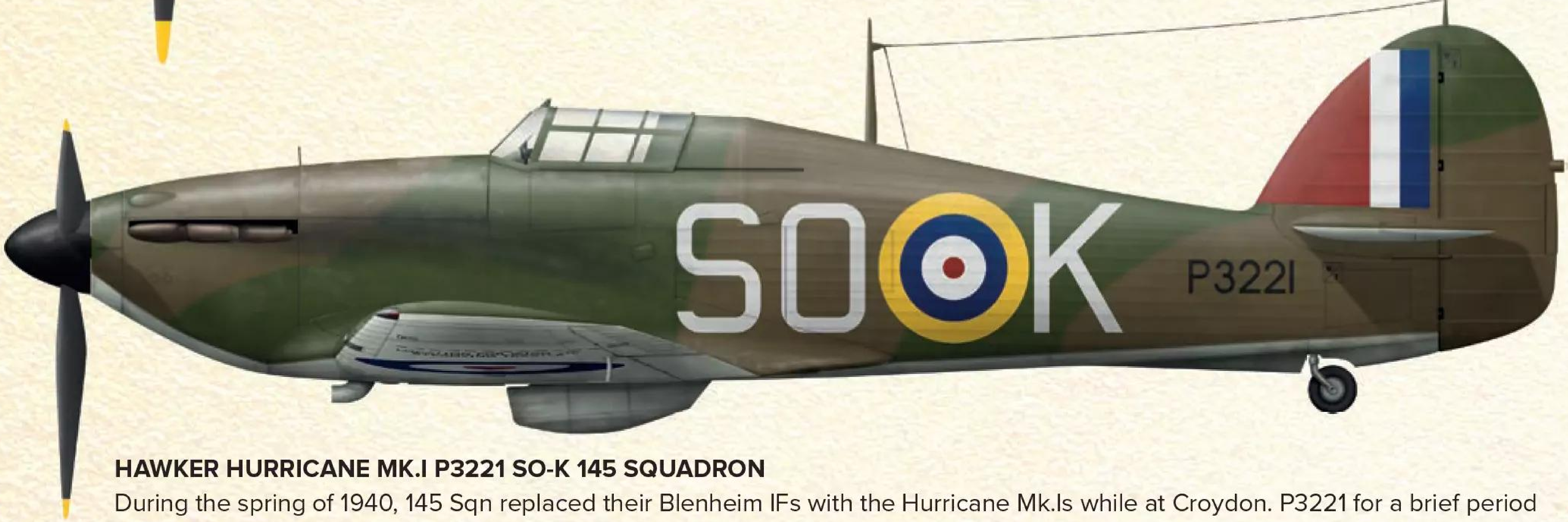
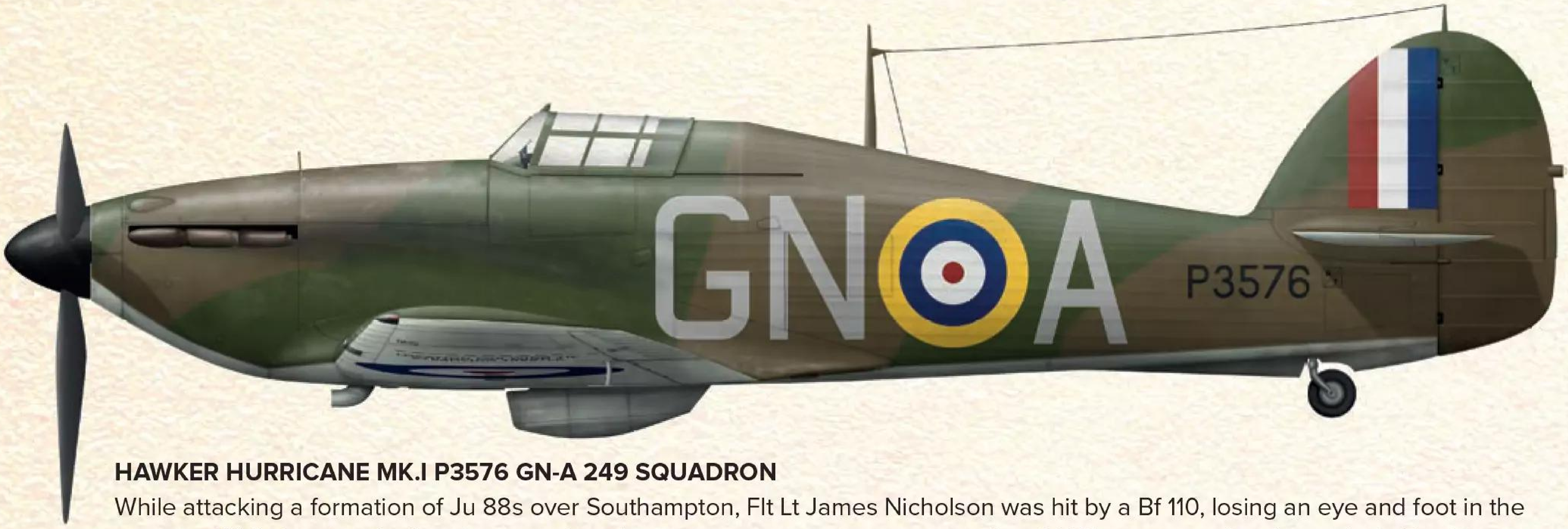


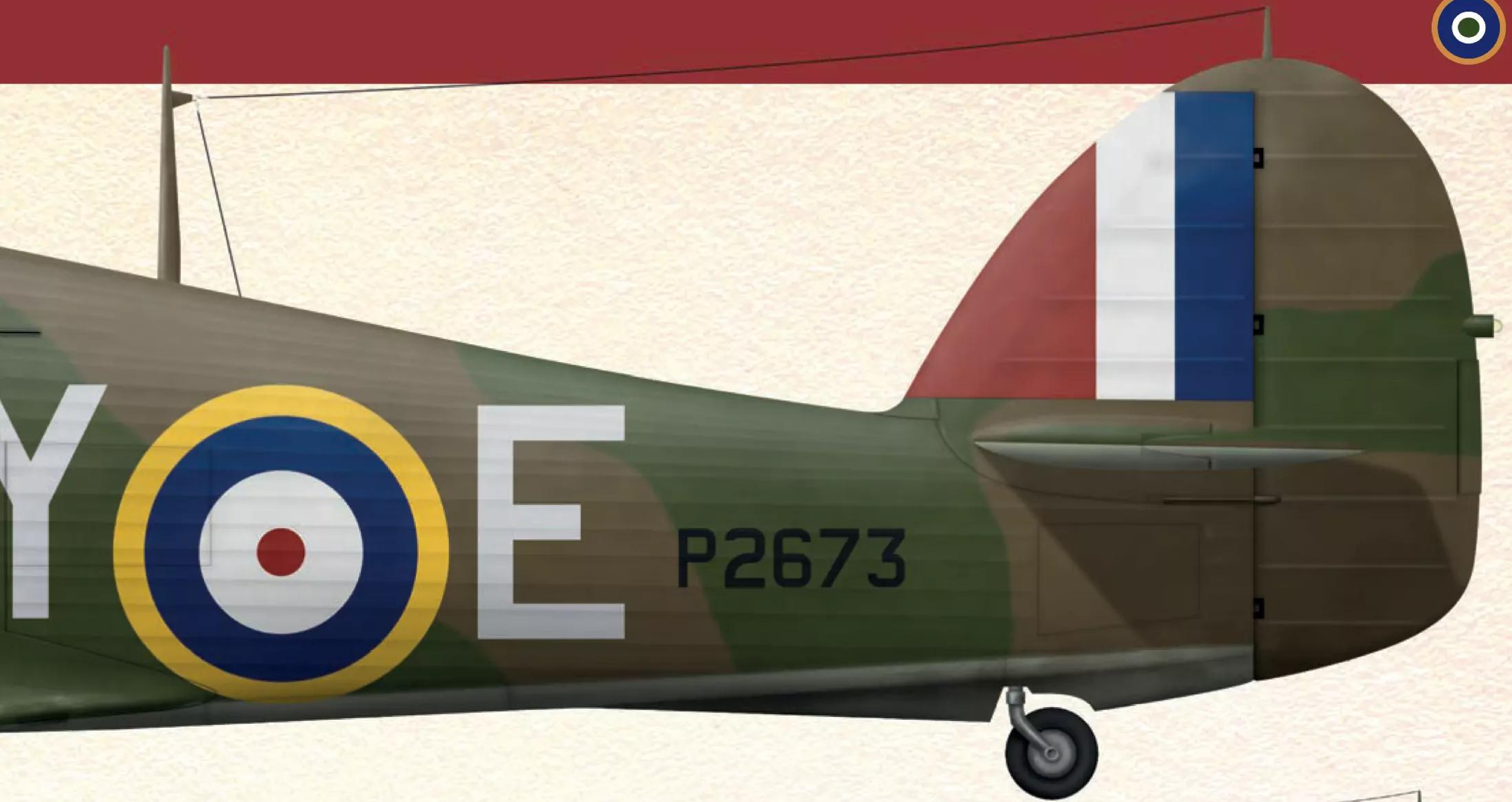
HAWKER HURRICANE MK.I P2673 VY-E 85 SQUADRON
Having claimed three destroyed and one damaged during the Battle of Britain, Sgt J. H. M. Ellis was flying L1915 VY-B when he was damaged and made it back to England before baling out. Three days later, in P2673, he was shot down by a Bf 109 near Kenley on September 1, 1940. His remains were not identified until 1992.

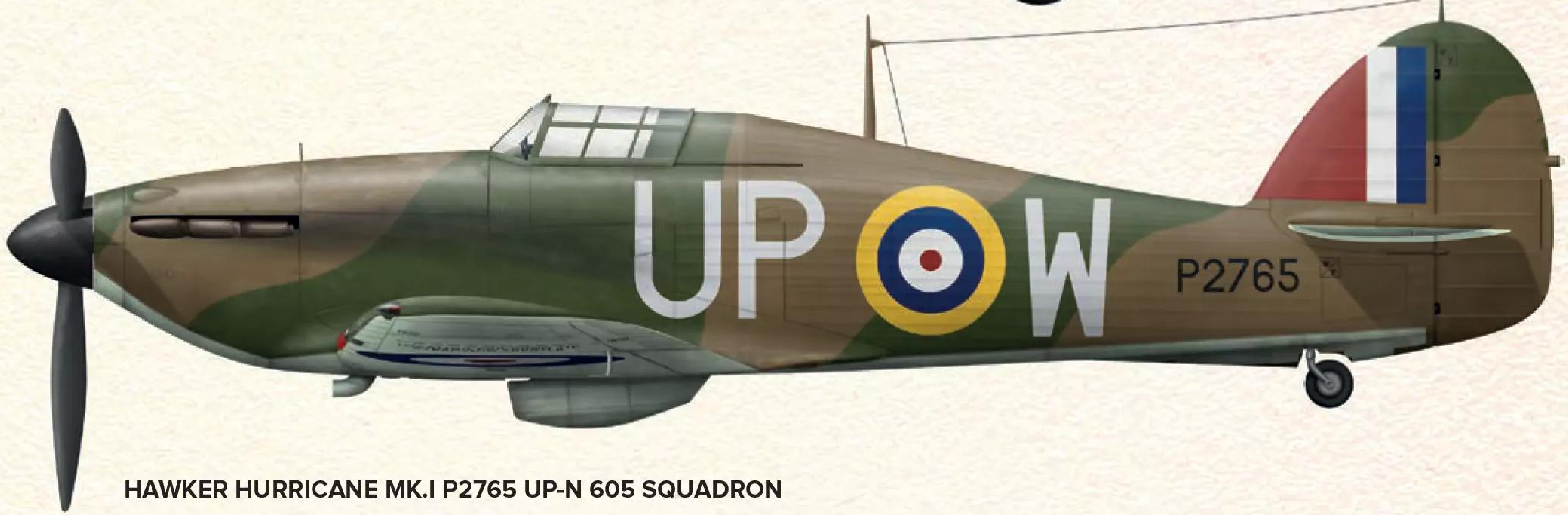


HAWKER HURRICANE MK.I P3221 SO-K 145 SQUADRON
During the spring of 1940, 145 Sqn replaced their Blenheim IFs with the Hurricane Mk.Is while at Croydon. P3221 for a brief period had an unusual modification; Adrian Hope Boyd replaced the standard canopy with a single piece with no frame which improved visibility. But it was not officially approved and had to revert back to the standard design.



HAWKER HURRICANE MK.I P3576 GN-A 249 SQUADRON
While attacking a formation of Ju 88s over Southampton, Flt Lt James Nicholson was hit by a Bf 110, losing an eye and foot in the process. While leaving the burning aeroplane he saw an opportunity to get another Bf 110 so returned to the cockpit. For this action he was awarded the only VC of Fighter Command.





HAWKER HURRICANE MK.I P2765 UP-N 605 SQUADRON

On September 9, 1940, the New Zealand pilot PO James Humphreys were tasked with intercepting a formation of He 111s. He was bounced by a Bf 110 and was forced to bail out near Borden, Surrey. During his descent, he was fired upon and hit once by British soldiers.

315mph, 85mph faster than the Gloster Gauntlet and 133mph faster than the Hawker Demon.

Work on both the aircraft and the engine continued and the following June the Air Ministry placed an order for 600 aircraft. The first production Hurricane, L1547, differed little from the prototype but was fitted with the Merlin II and first flew on October 12, 1937. It was just before Christmas that 111 Squadron at RAF Northolt received the first four Hurricanes, L1548-L1551. More followed in the New Year and by February, the squadron was up to full strength with 16 Hurricanes. 111 Squadron was followed by 3 and 56 Squadrons.

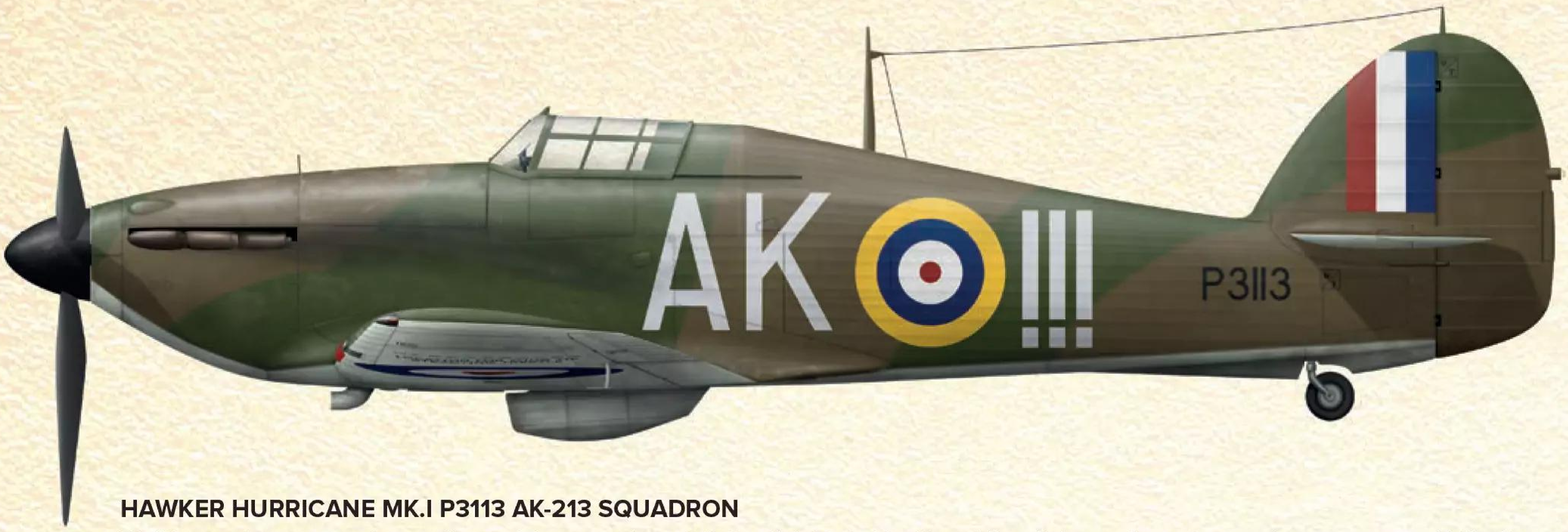
The pilots gradually got used to the revolutionary new fighter, which was far more powerful than the biplanes they had been used to, and the retractable undercarriage was a new concept with more than one pilot forgetting to lower their gear during landing.

Even before the first batch had been completed, Camm worked on revising and improving the Hurricane, adding armour plating and a bulletproof forward windscreen. The all-metal wing was introduced and the fixed-pitch two-blade propeller was replaced with the three-blade Hamilton Standard, adding an extra 17mph to the top speed. All these features took time to enter production and it was not until the spring of 1940 that 111 Squadron began to receive the improved Mk.I.

The first Hurricanes to be lost during the war were the victims of friendly fire during what became known as the Battle of Barking Creek.

On September 6, 1939, an unidentified aircraft was picked up. With tensions running high, 151 Squadron scrambled their Hurricanes, followed shortly after by two reserves flown by Pilot Officers Montague Hulton-Harrop and Frank Rose. Three Spitfire squadrons were also scrambled and those of 74 Squadron intercepted and downed the two Hurricanes although Rose survived.

It was not until the following month when 46 and 72 Squadrons intercepted nine He 115B seaplanes on October 21, damaging one and destroying three in the process. Prior to this during the Phoney War 1, 73, 85 and 87 Squadrons were sent to France to support the British ➤



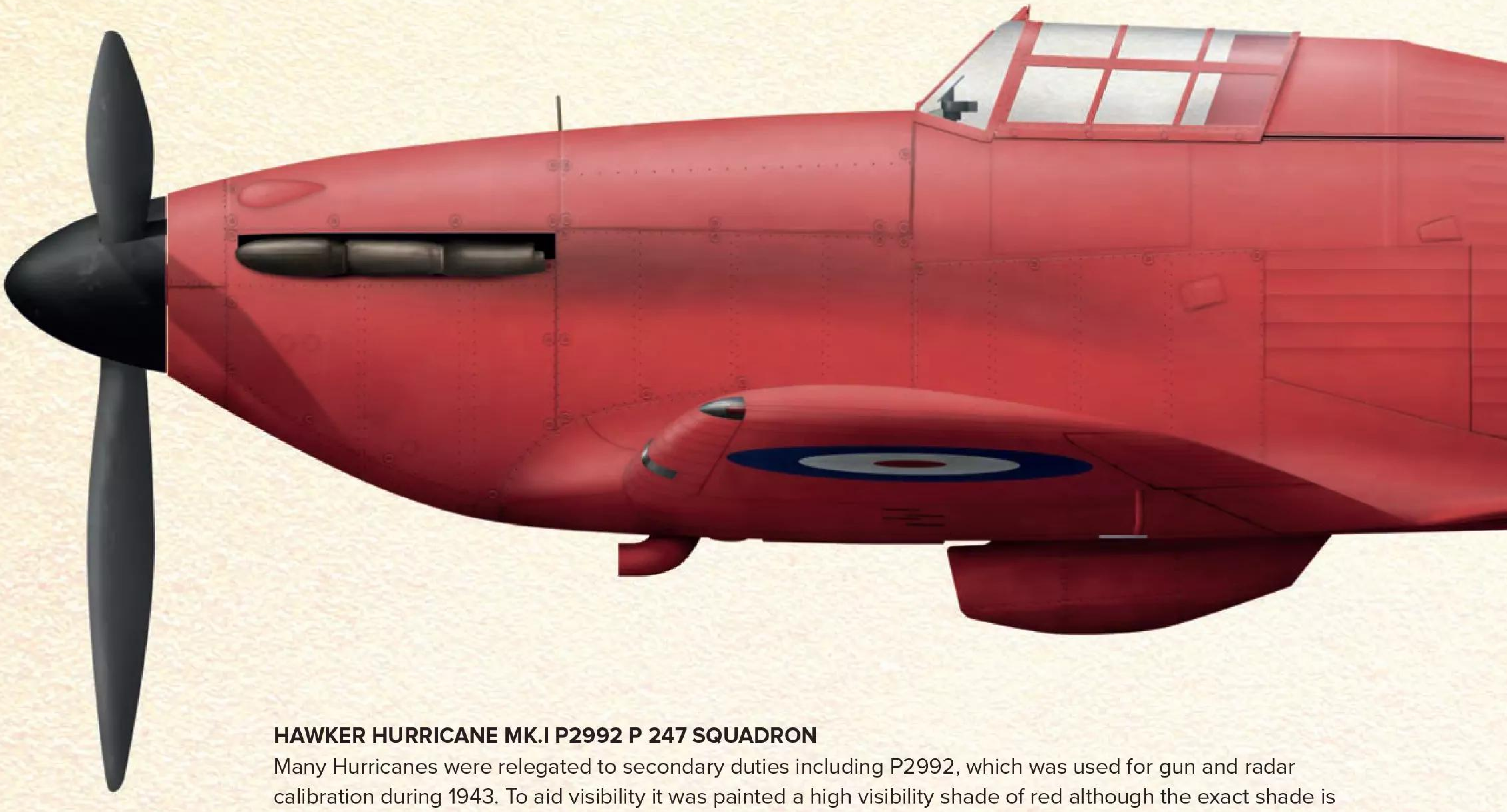
HAWKER HURRICANE MK.I P3113 AK-213 SQUADRON
P3113 was the personal aeroplane of the squadron CO Sqn Ldr D. S. MacDonald and the exclamation marks represented kills. On September 15, 1940, it was being flown by Sgt R. T. Llwellyn when he was attacked by a Bf 110 and forced to bail out.

Expeditionary Force, 1 Squadron moving to Octevill near Le Havre on September 7. Dowding was reluctant to commit his forces, accurately predicting that once France had fallen he would need every available fighter and pilot to defend Great Britain, although more fighter and bomber squadrons were posted to France before it fell.

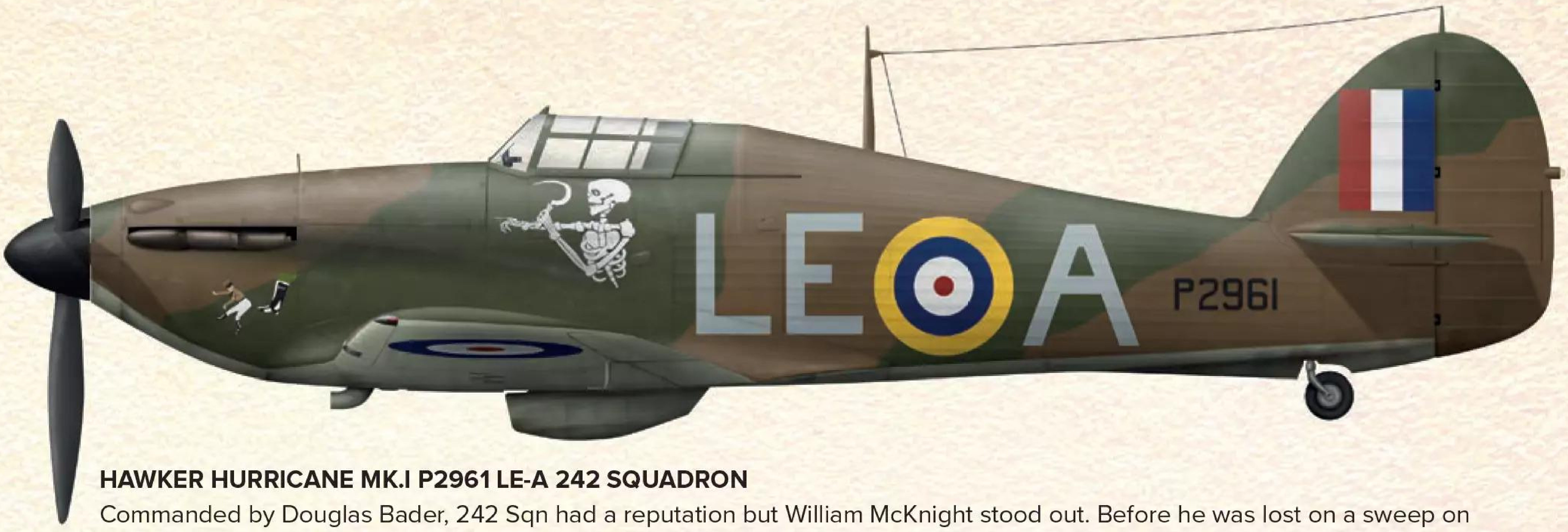
As the evacuation took place all available aircraft returned to England to prepare for the coming Battle of Britain. Although slightly overshadowed by the Spitfire, it was during the summer of 1940 that the Hurricane really proved its worth.

By the time of D-Day four years later it had been replaced by vastly superior fighters, but between July and October 1940 the 36 Hurricane squadrons flew against the Luftwaffe. While there was a substantial amount of combat with the Bf 109, the Hurricanes were primarily tasked with intercepting the bombers.

There were a great many feats of valour during the battle but two in particular



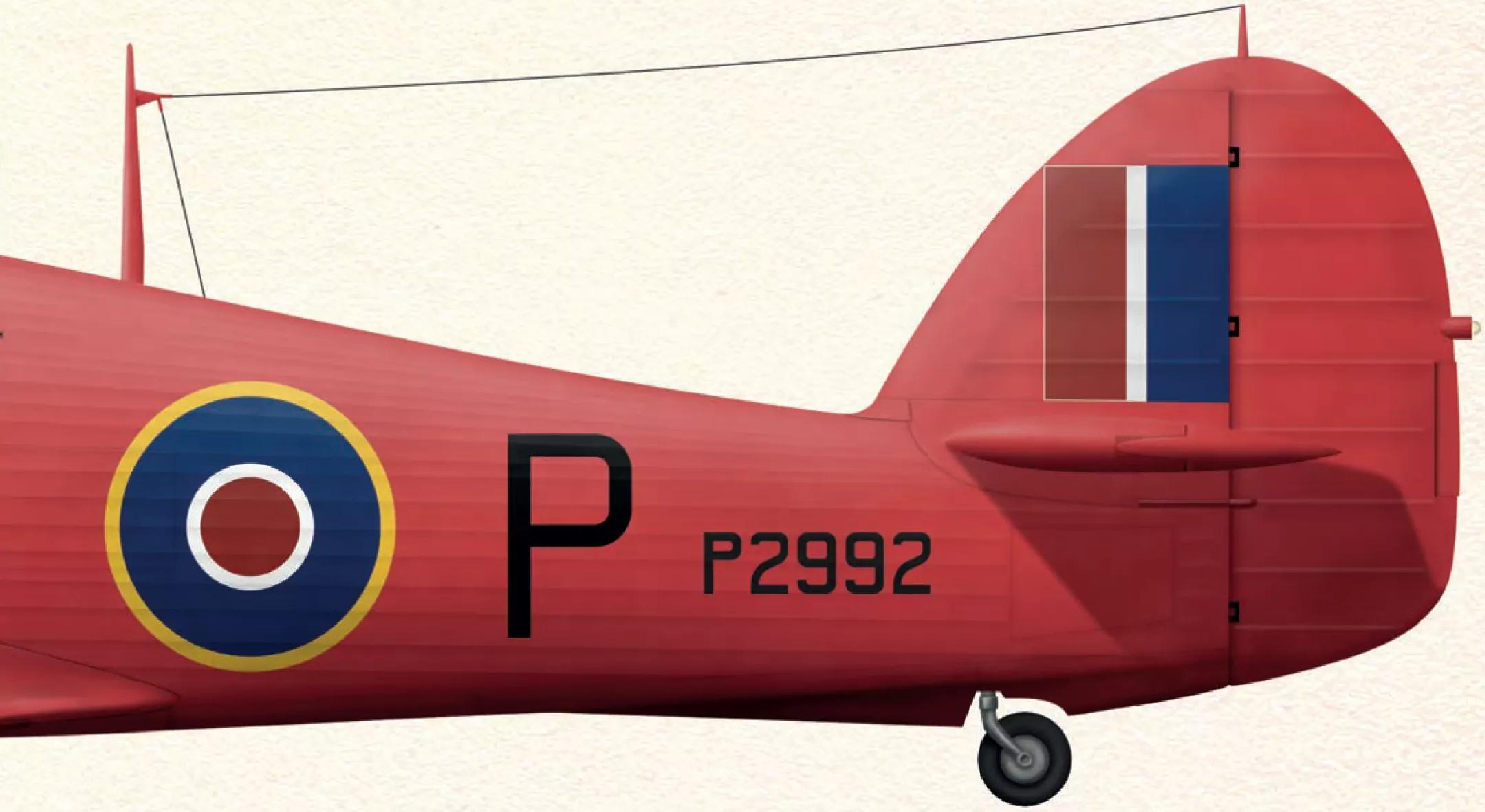
HAWKER HURRICANE MK.I P2992 P 247 SQUADRON
Many Hurricanes were relegated to secondary duties including P2992, which was used for gun and radar calibration during 1943. To aid visibility it was painted a high visibility shade of red although the exact shade is unknown.



HAWKER HURRICANE MK.I P2961 LE-A 242 SQUADRON
Commanded by Douglas Bader, 242 Sqn had a reputation but William McKnight stood out. Before he was lost on a sweep on January 12, 1941, he had made 17 claims. As well as the squadron art of Hitler being kicked, McKnight also added his own personal art on the side of P2961.

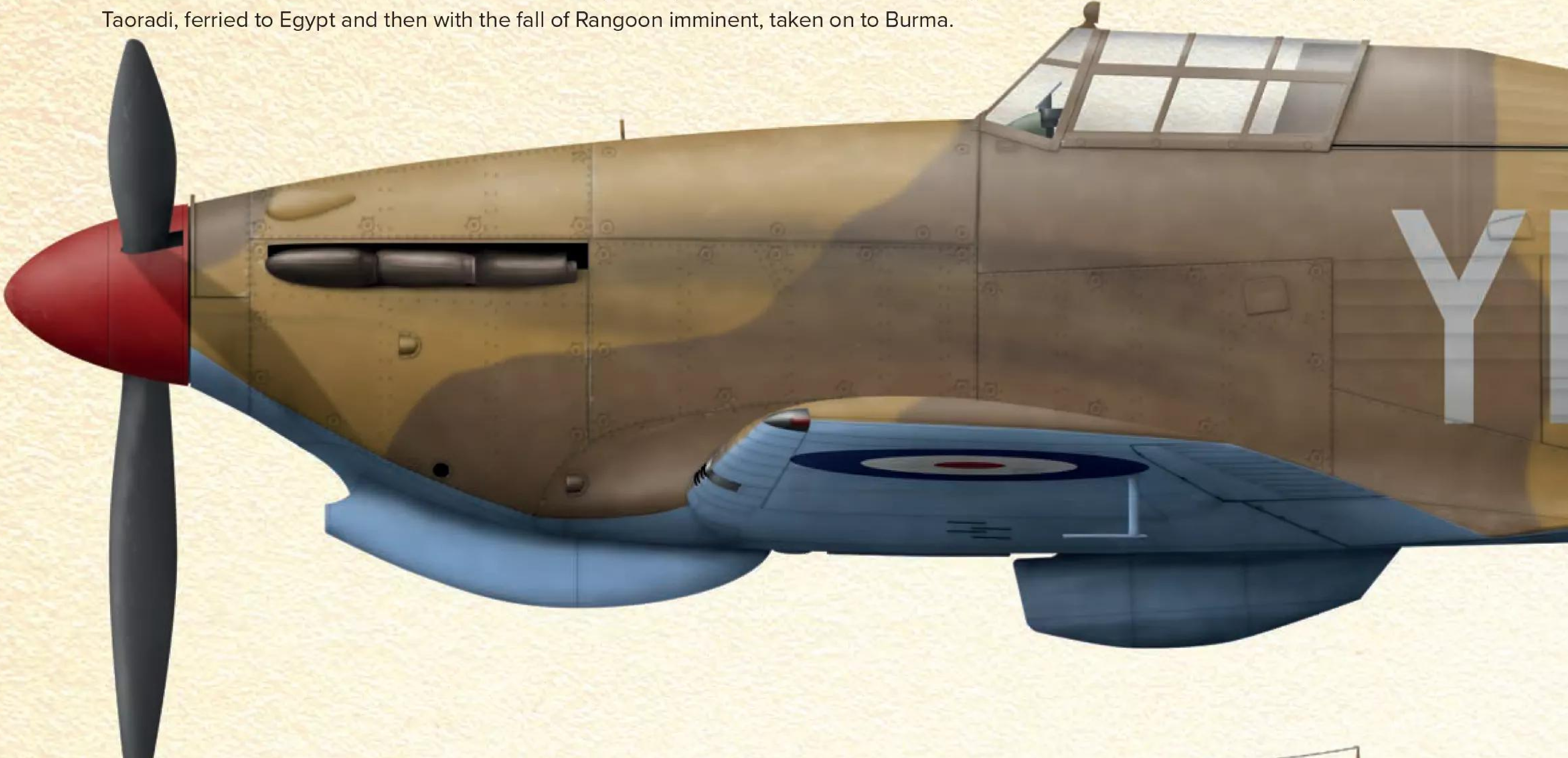
stand out. The first is the action by Flt Lt Eric Nicolson of 249 Squadron, who has the distinction of being awarded the only Victoria Cross to be awarded for an action taking place within the mainland UK. On August 16, he was about to bail out from Hurricane P3576 when he saw the opportunity to attack a Bf 110 and so re-entered the burning cockpit to open fire on it. He suffered from severe burns but received the VC as a result of his actions. The second was Auxiliary Pilot Archie McKellar of 605 Squadron who made 19 claims during the Battle of Britain, five of those on October 7, his total when he was killed on November 1 was 21.

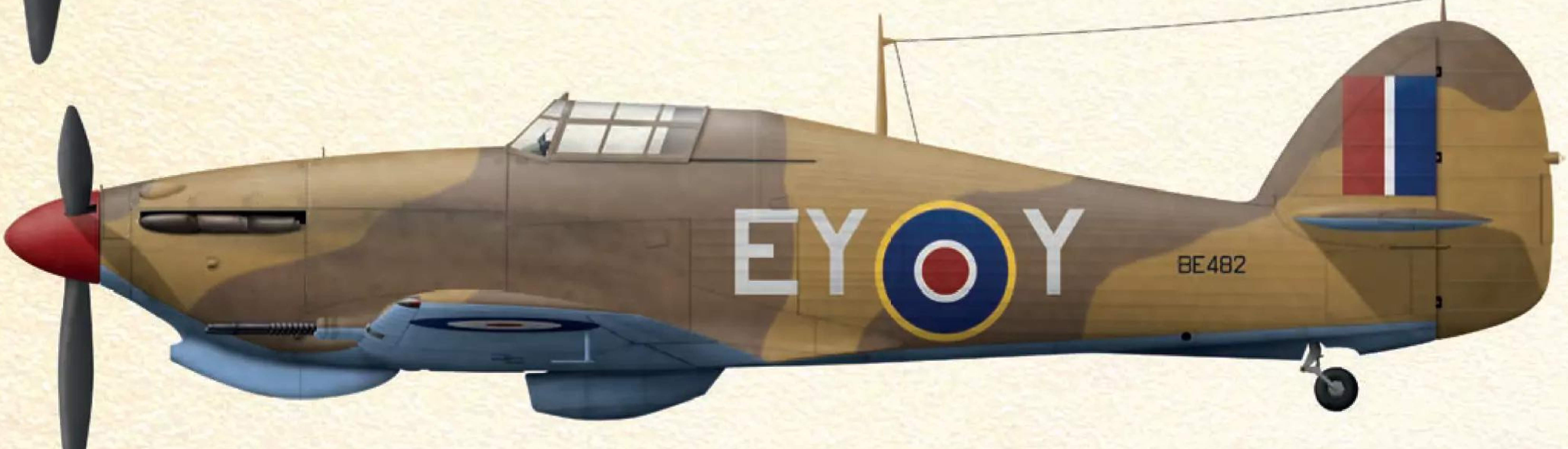
With the onset of winter and decline in daylight raids the Hurricane was, along with Blenheims and Defiants, tasked with night defence. Although the improved Mk.IIB and cannon armed Mk.IIC did produce ➤



HAWKER HURRICANE MK.IIB TROP Z5628 YB-L 17 SQUADRON

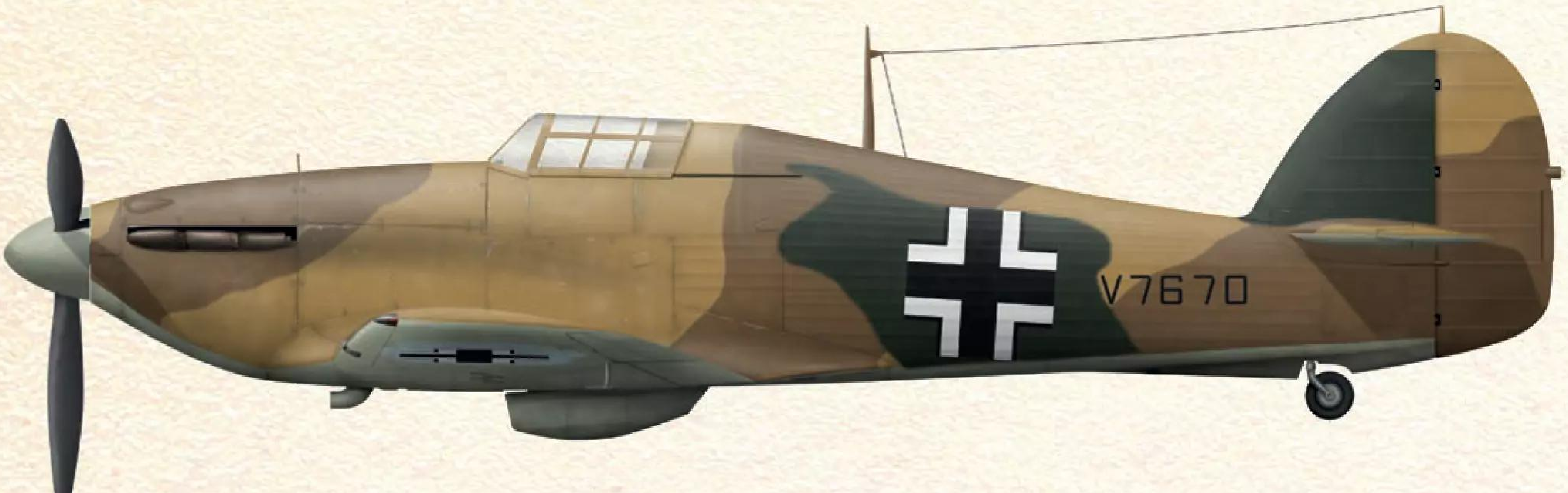
Z5628 served with 17 Sqn in the Far East where they were primarily tasked with defending Burma. Z5628 had originally been shipped to Taoradi, ferried to Egypt and then with the fall of Rangoon imminent, taken on to Burma.





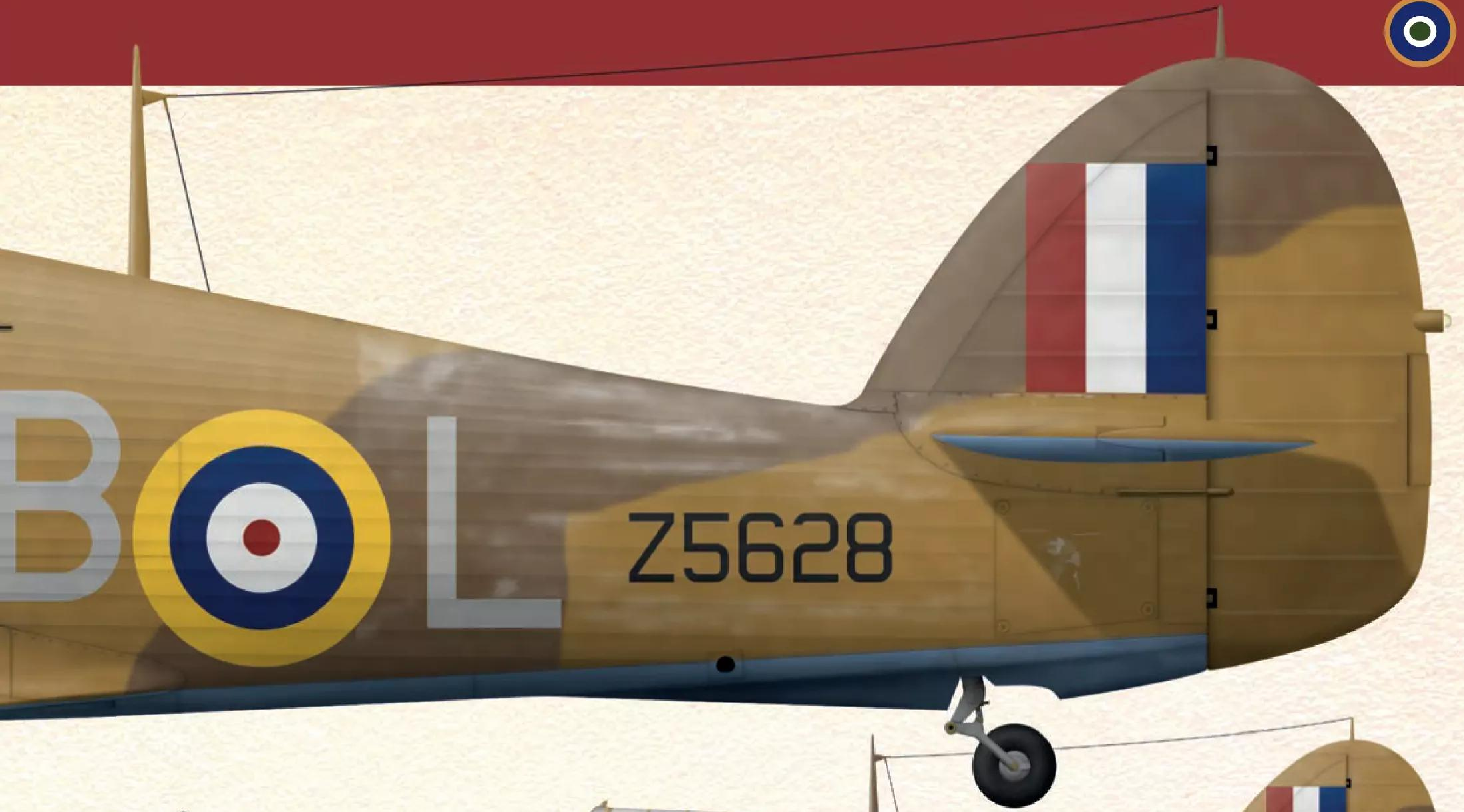
HAWKER HURRICANE MK.IIC TROP BE482 EY-Y 80 SQUADRON

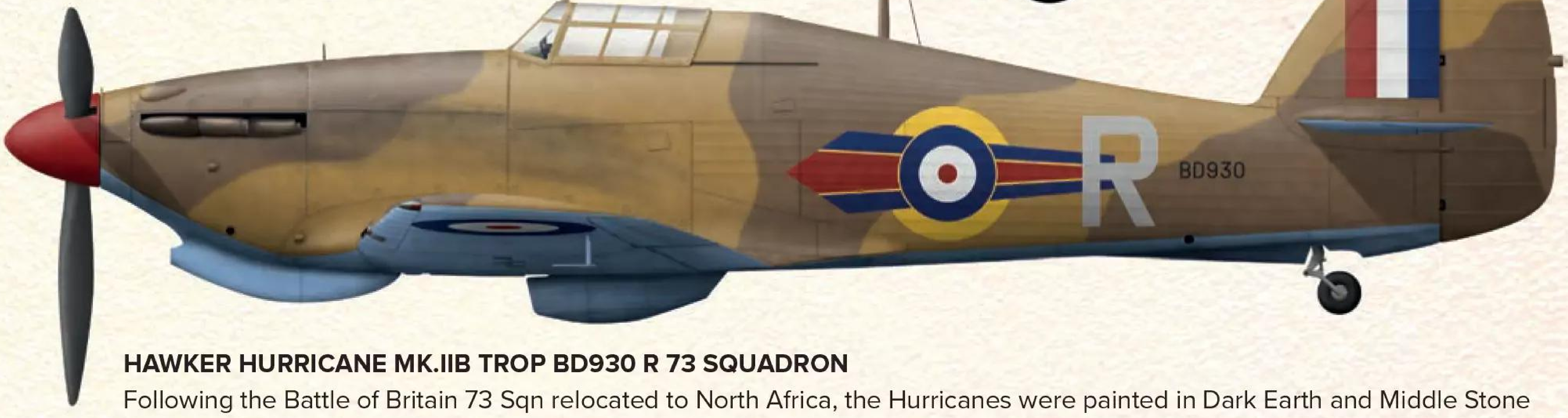
Having replaced the ageing Gloster Gladiators with Hurricanes while in Greece, the squadron returned to North Africa to support the Allied campaign in the Western Desert. In early 1942 the Mk.I were eventually replaced with the Mk.IIC which were used until just before the Battle of El Alamein when Spitfires started to arrive.



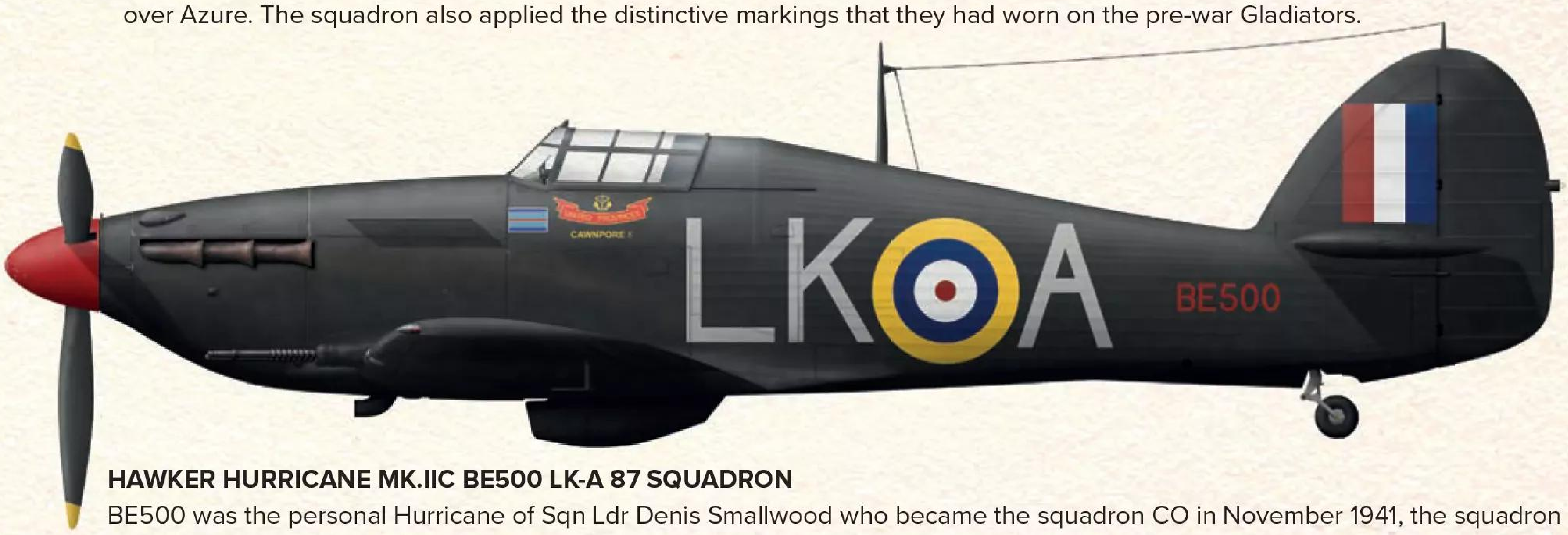
HAWKER HURRICANE MK.I V7670

V7670 was used by 261 Sqn during early 1941 in North Africa when it was captured and repainted with German markings. It was recaptured at Kambut, Libya in January 1942 following Operation Crusade.





HAWKER HURRICANE MK.IIB TROP BD930 R 73 SQUADRON
Following the Battle of Britain 73 Sqn relocated to North Africa, the Hurricanes were painted in Dark Earth and Middle Stone over Azure. The squadron also applied the distinctive markings that they had worn on the pre-war Gladiators.



HAWKER HURRICANE MK.IIC BE500 LK-A 87 SQUADRON
BE500 was the personal Hurricane of Sqn Ldr Denis Smallwood who became the squadron CO in November 1941, the squadron was a night fighter unit from March 1941 until November 1942 when it was posted to Gibraltar for Operation Torch.

results, a single aircraft flying alone at night trying to follow instructions from control who were in turn tracking enemy aircraft via radar did not get spectacularly high results. Plus, the introduction of radar necessitated a second crew member.

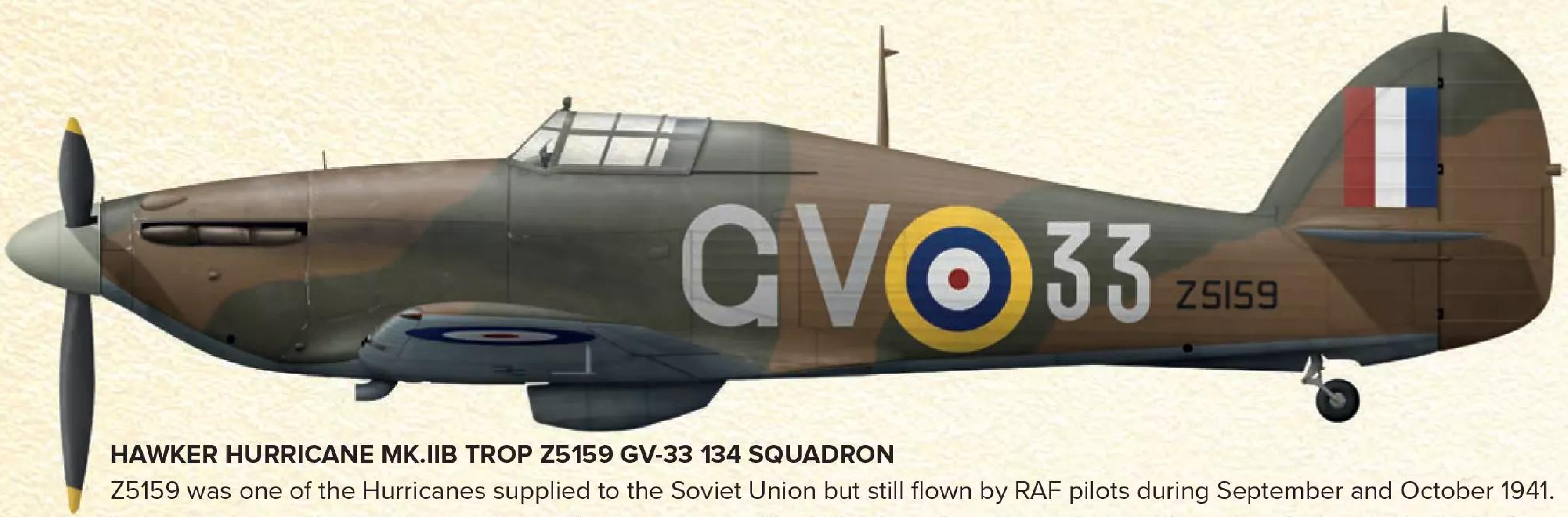
This was not the end of the Hurricane's nocturnal activities however, as they went on to fly night intruder missions over Europe from 1942. The MK.IIA differed little from the Mk.I but was powered by the Merlin III, providing a top speed of 330mph at 16,000ft. Extra guns were added to the Mk.IIB bringing the total to 12 but on operations it was common to remove at least one pair at the behest of the pilot. The Mk.IIC saw the Brownings replaced with four 20mm Hispano cannon, two in each wing. Despite being fewer guns the destructive power of the cannon was a big improvement and all subsequent Hawker fighters were also equipped with them.

The Hurricane may have been replaced by superior aircraft on the home front

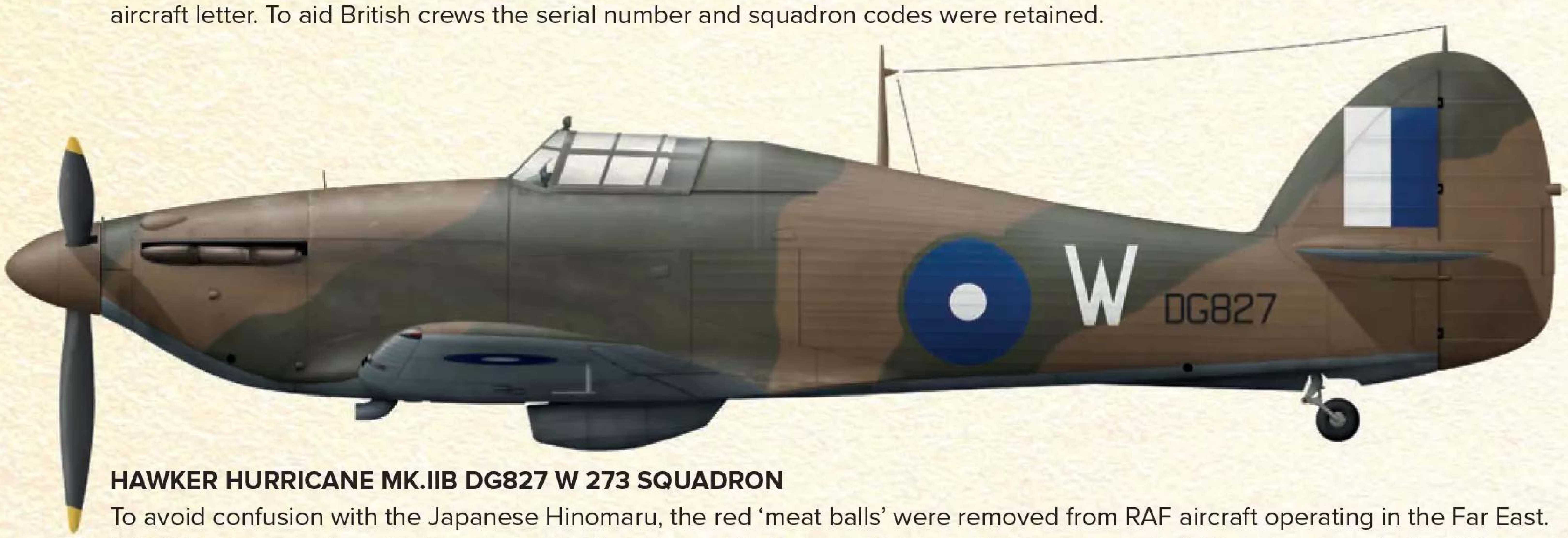
➤

Hurricane

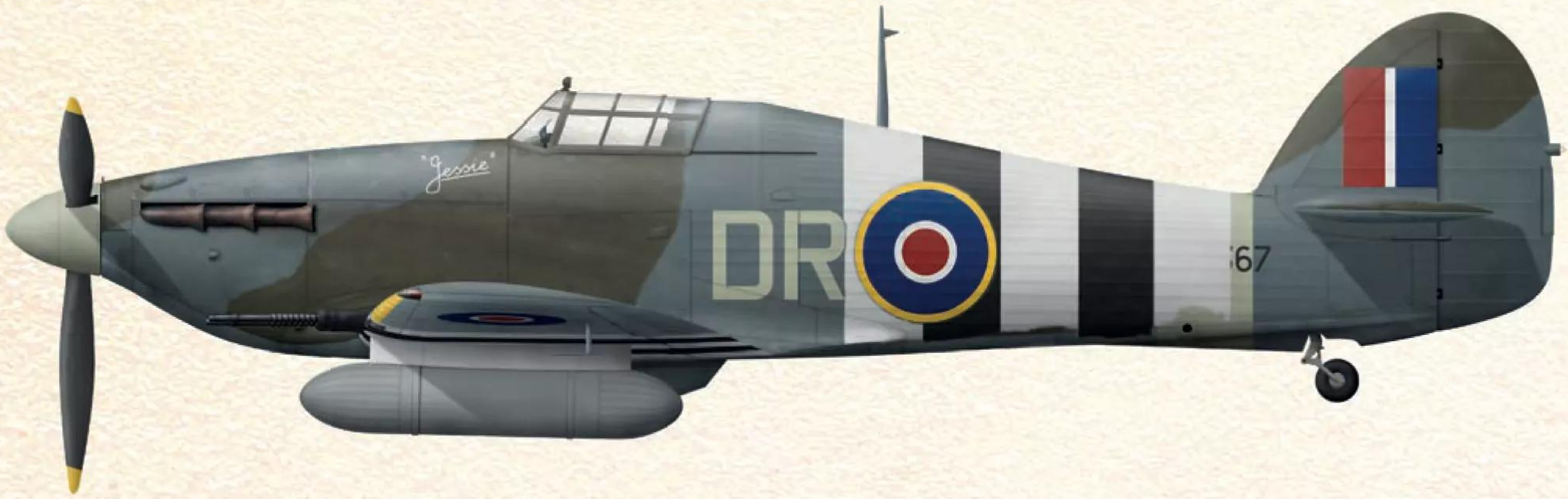
VARIANTI	LENGTH	SPAN	HEIGHT	ENGINE
Prototype	31ft 6in / 9.60m	40ft / 12.19m	13ft 6in / 4.11m	Rolls-Royce Merlin C
Mk.I	31ft 4in / 9.33m	40ft / 12.19m	12ft 11.5in / 3.95m	Rolls-Royce Merlin III
Mk.IIA	32ft 2.25in / 9.83m	40ft / 12.19m	13ft 1in / 3.99m	Rolls-Royce Merlin XX
Mk.IIB	32ft 2.25in / 9.83m	40ft / 12.19m	13ft 1in / 3.99m	Rolls-Royce Merlin XX
Mk.IIC	32ft 2.25in / 9.83m	40ft / 12.19m	13ft 1in / 3.99m	Rolls-Royce Merlin XX



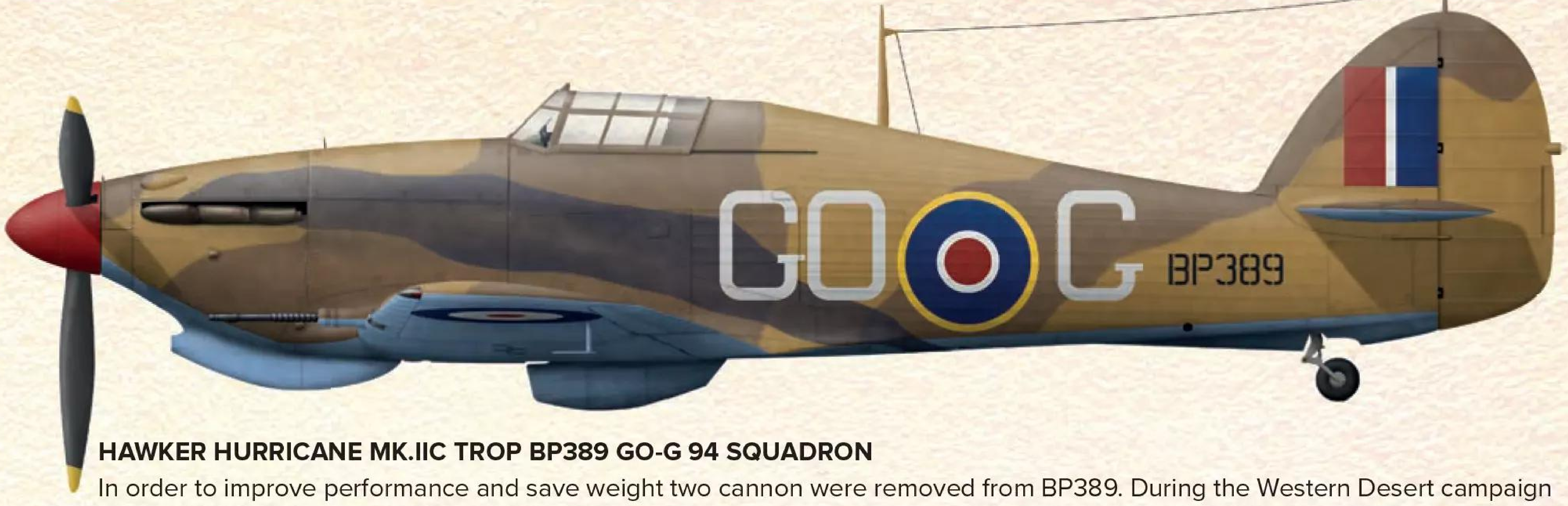
HAWKER HURRICANE MK.IIB TROP Z5159 GV-33 134 SQUADRON
Z5159 was one of the Hurricanes supplied to the Soviet Union but still flown by RAF pilots during September and October 1941. Instead of letters the Soviets used a numbering system with all 134 Squadron aircraft being 30s and replacing the individual aircraft letter. To aid British crews the serial number and squadron codes were retained.



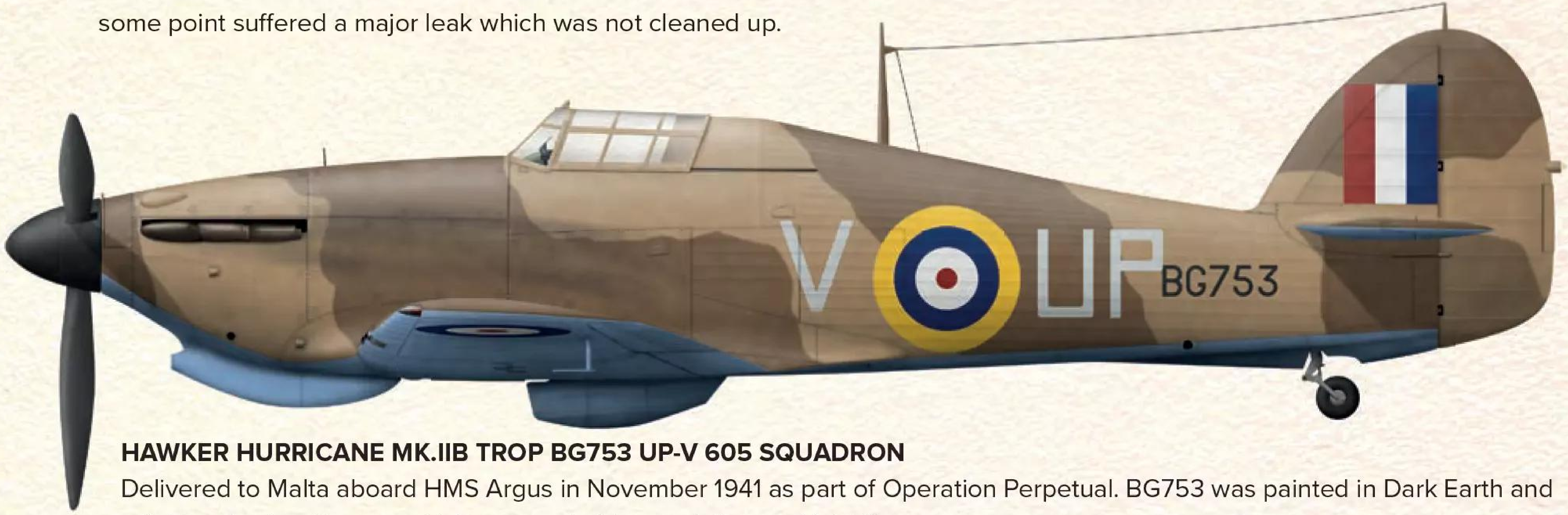
HAWKER HURRICANE MK.IIB DG827 W 273 SQUADRON
To avoid confusion with the Japanese Hinomaru, the red 'meat balls' were removed from RAF aircraft operating in the Far East. DG827 appears to have had a temporary alteration made before official markings were applied. The aircraft and pilot, WO Zayzeirski, were lost when he hit a tree on October 29, 1943, during a dummy attack.



HAWKER HURRICANE MK.IIC MW367 DR-B 1697 FLIGHT
Following the invasion of France, 1697 Flight based at RAF Northolt was used to deliver important dispatches and post to Advanced Landing Grounds. The load was carried behind the pilot and in adapted external fuel tanks.



HAWKER HURRICANE MK.IIC TROP BP389 GO-G 94 SQUADRON
In order to improve performance and save weight two cannon were removed from BP389. During the Western Desert campaign the squadron flew a mix of Mk.IIB Trop and IIC Trop with a variety of gun configurations. Photos seem to indicate the engine at some point suffered a major leak which was not cleaned up.



HAWKER HURRICANE MK.IIB TROP BG753 UP-V 605 SQUADRON
Delivered to Malta aboard HMS Argus in November 1941 as part of Operation Perpetual. BG753 was painted in Dark Earth and a lighter shade of brown which was probably a variation on Light Stone.

but Camm's design was to prove rugged and adaptable in other theatres of war. As early as July 1940, Hurricanes were being diverted to Malta to supplement the Sea Gladiators in defending the island against Italian forces. Mussolini's intention was to gain territories while Britain was preoccupied with the expected invasion. Despite high losses, Hurricanes continued to bolster the island's defences until sufficient Spitfires could be spared and sent to Malta.

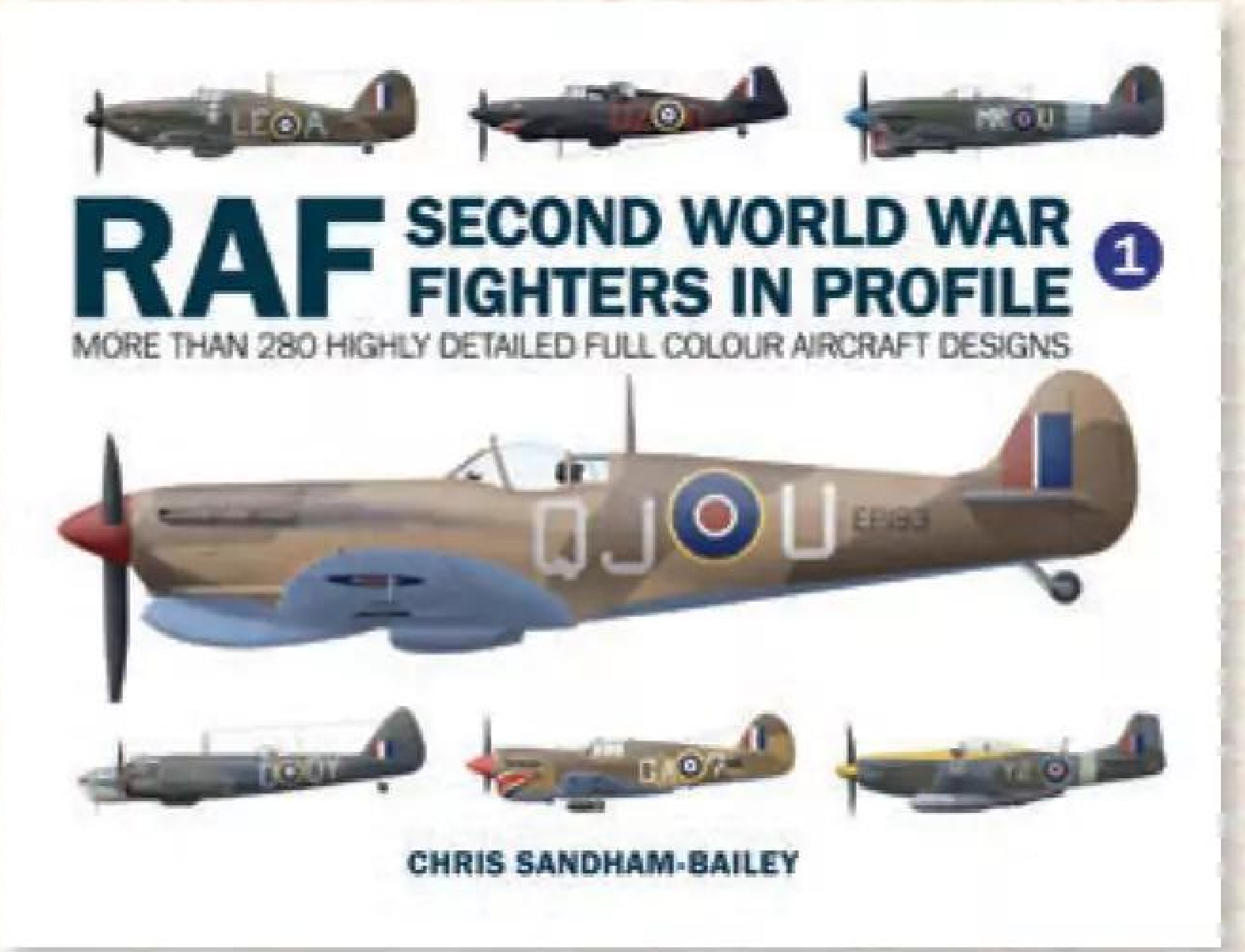
One theatre where the Hurricane excelled was North Africa, with the aircraft initially being sent to Egypt and by the start of December 1940 both 73 and 274 Squadrons were at full strength. Aircraft were either ferried from Gibraltar using long range tanks or shipped to Takoradi on the Gold Coast then flown across Africa. Due to the conditions it was necessary to fit Vokes Filters, which were suitable for the desert conditions. The Hurricanes were soon outclassed by Regia Aeronautia and Luftwaffe fighters and began being phased out with the arrival of P-40 Tomahawks. To prolong the life of the Hurricane the Mk.IID was introduced as a tank busting ground-attack variant, fitted with a 40mm anti-tank cannon under each wing.

One of the RAF Hurricane's less well known theatres of operation was Murmansk in the north west of the Soviet Union. To aid Stalin, Churchill had agreed to supply equipment including up to 3000 Hurricanes, but before these could be used both the pilots and ground crew had to be trained to use them. Therefore 151 Wing was formed out of 81 and 134 Squadrons for this purpose. The RAF pilots found themselves not only training but flying operationally and on September 12, 1941, a patrol encountered a Bf 110, followed later in the day by a flight of Bf 109 E and an Hs 126. Three Bf 109 Es were claimed in the ensuing fight. By October 23, sufficient Russians had been trained for the RAF pilots to return to the UK leaving the aircraft to form the nucleus of No 1 Hurricane squadron.

Finally, the Hurricanes found their way to the Far East where many types were sent having been supplanted in Europe by more advanced aircraft. But even then the Hurricane was considered a vast improvement on the Brewster Buffalo which had struggled against the Imperial Japanese Air Force. Just like in the Battle of Britain, the Hurricane was most effective attacking the bombers but as the war progressed they also switched to the ground-attack role.

The Hurricane may have been quickly eclipsed by fighters on both sides during the war but at a time when the RAF urgently needed fighters and the ability to keep them in the air, the Hurricane was there. The simple construction meant they could be produced far more rapidly than the Spitfire and most battle damage could be repaired at the station. It may not have been in quite the same league as the Spitfire but the pilots loved it and if it were not for the Hurricane the Battle of Britain would have been very different. ■

For more, see:
RAF SECOND WORLD WAR FIGHTERS IN PROFILE
By Chris Sandham-Bailey
Published by Mortons Media Group
Hardback. Price on Amazon £30.87



RAF SECOND WORLD WAR FIGHTERS IN PROFILE 1

MORE THAN 280 HIGHLY DETAILED FULL COLOUR AIRCRAFT DESIGNS

CHRIS SANDHAM-BAILEY

Independent Force O/400s being readied for operations. *Image: IWM Q 27679 Public Domain*

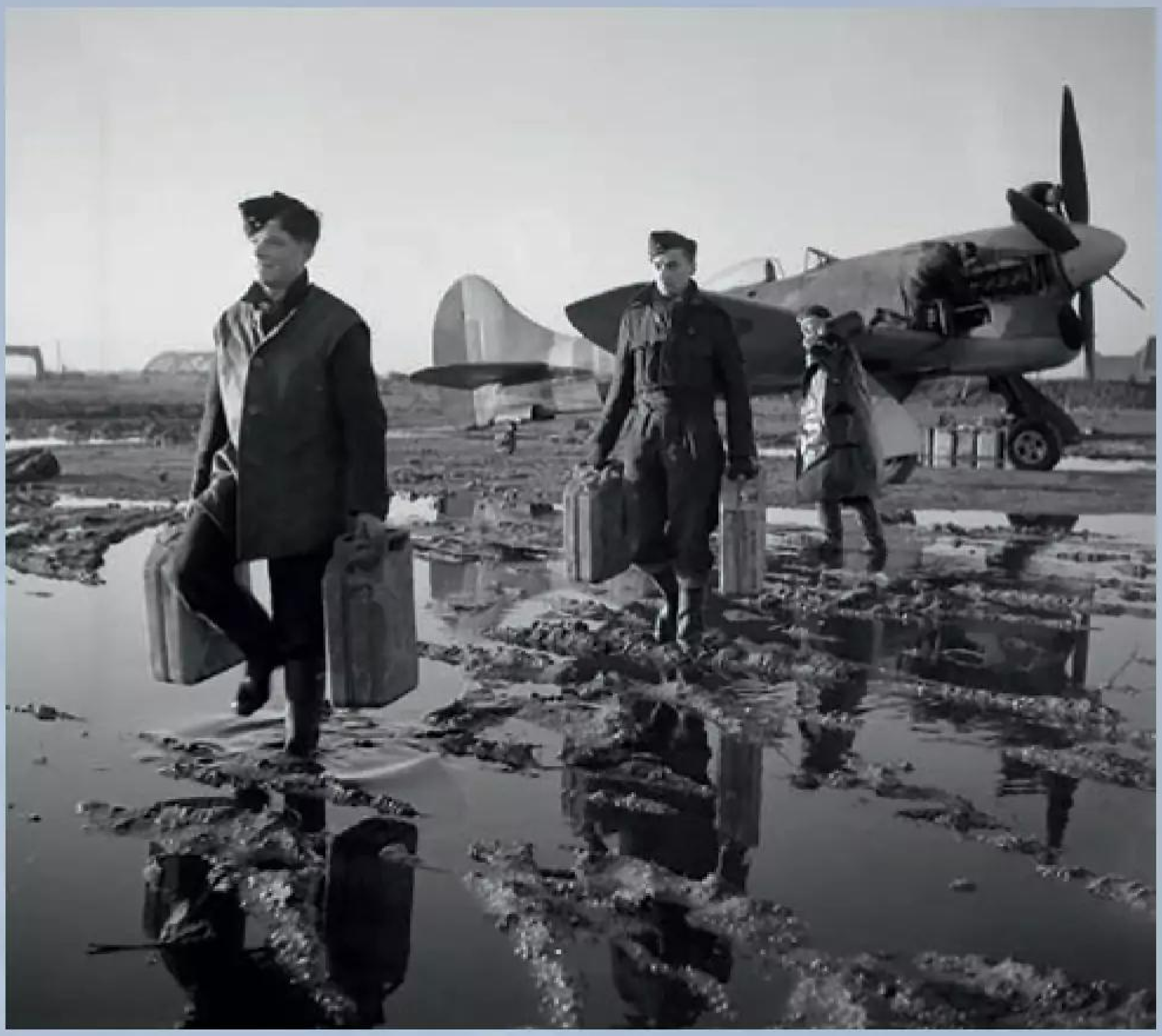
Refuelling the Classics

Mike and Julie Blenkinsop investigate the teams of technicians who kept the British air forces supplied with fuel through two world wars and the equipment they used to dispense it.

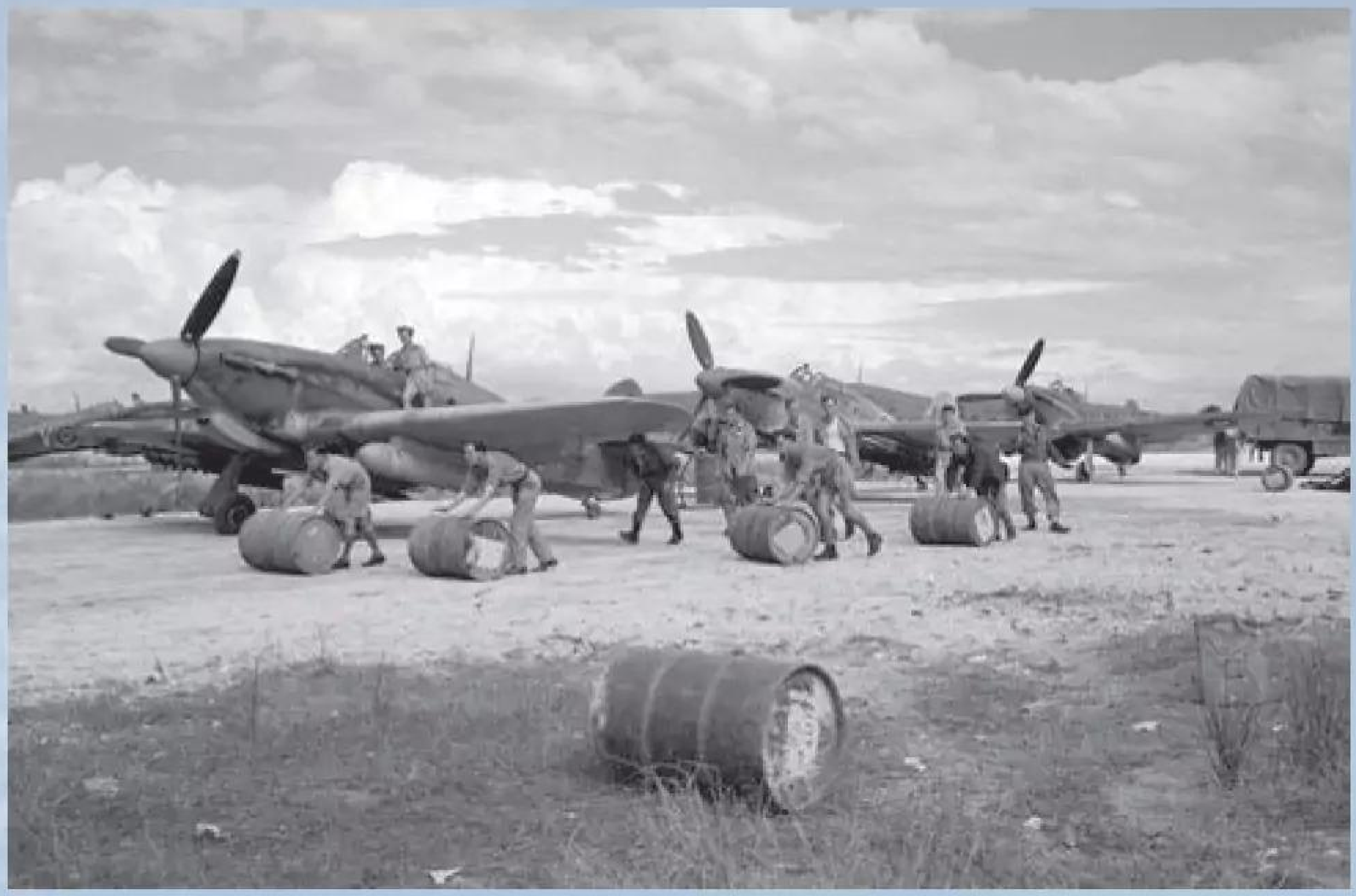
Handley Page O/100 aircraft 1459 ‘Le Tigre’ of N°. 3 Wing, RNAS, March 1917, Ochey airfield, France. *Image: IWM Public Domain*

In the very early days of flying, fuel for an aircraft was usually dispensed by taking cans of petrol from the local station to the plane. Two-gallon metal tins with screw tops would litter the fields of France at the end of the First World War! Necessity would bring the 50-gallon oil-drum onto the airfield. High grade spirit was necessary for the early fighters of the Royal Flying Corps and the Royal Naval Air Squadron and when the Royal Air Force was formed in April 1918, FGAS, ‘Fighting Grade Aviation Spirit’ became available. The fuel dump then became part of the airfield, usually located well away from buildings and aircraft and serviced by commercial fuel operators like BP and Shell-Mex.

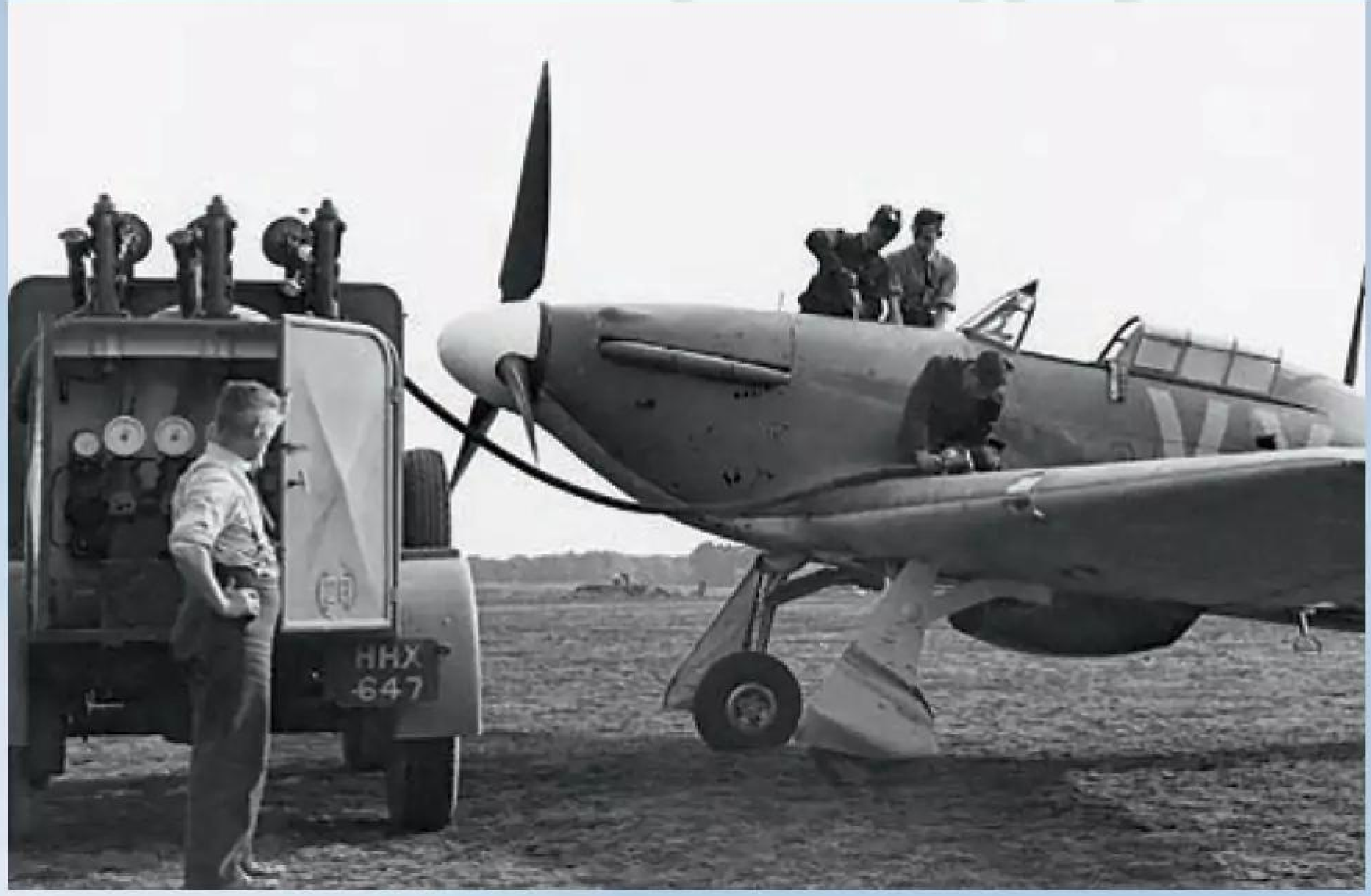
As aircraft developed, petrol was brought to the plane by fuel suppliers in dropside lorries but usually in petrol ➤



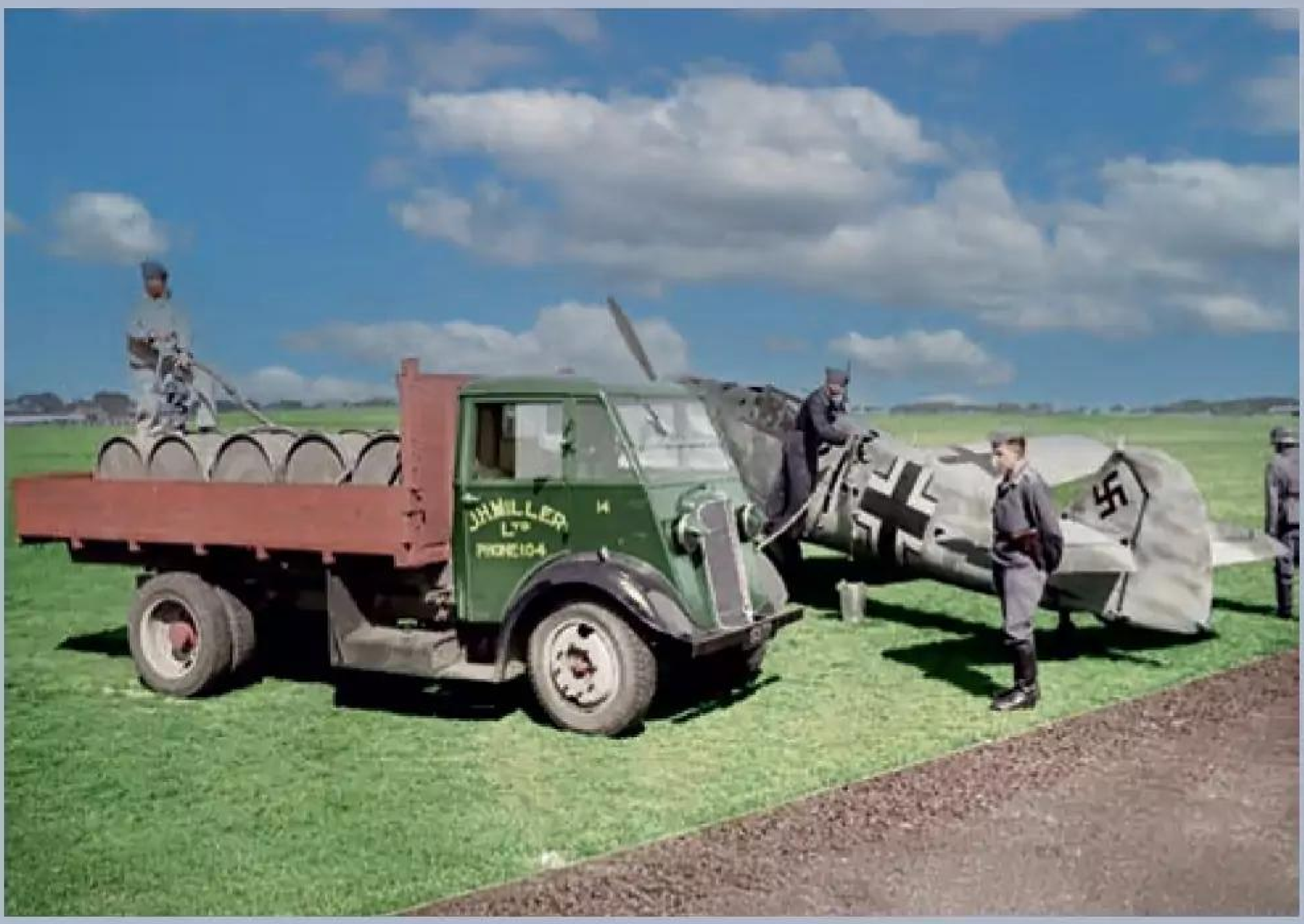
Royal Air Force – 2nd Tactical Air Force, 1943-1945. Ground crew servicing and refuelling a Hawker Tempest Mark V of N° 56 Squadron RAF, in flooded conditions after the heavy rains in Volkel, Holland. *Image: F/L N. S. Clark, RAF official photographer. IWM CL1676 Public Domain*



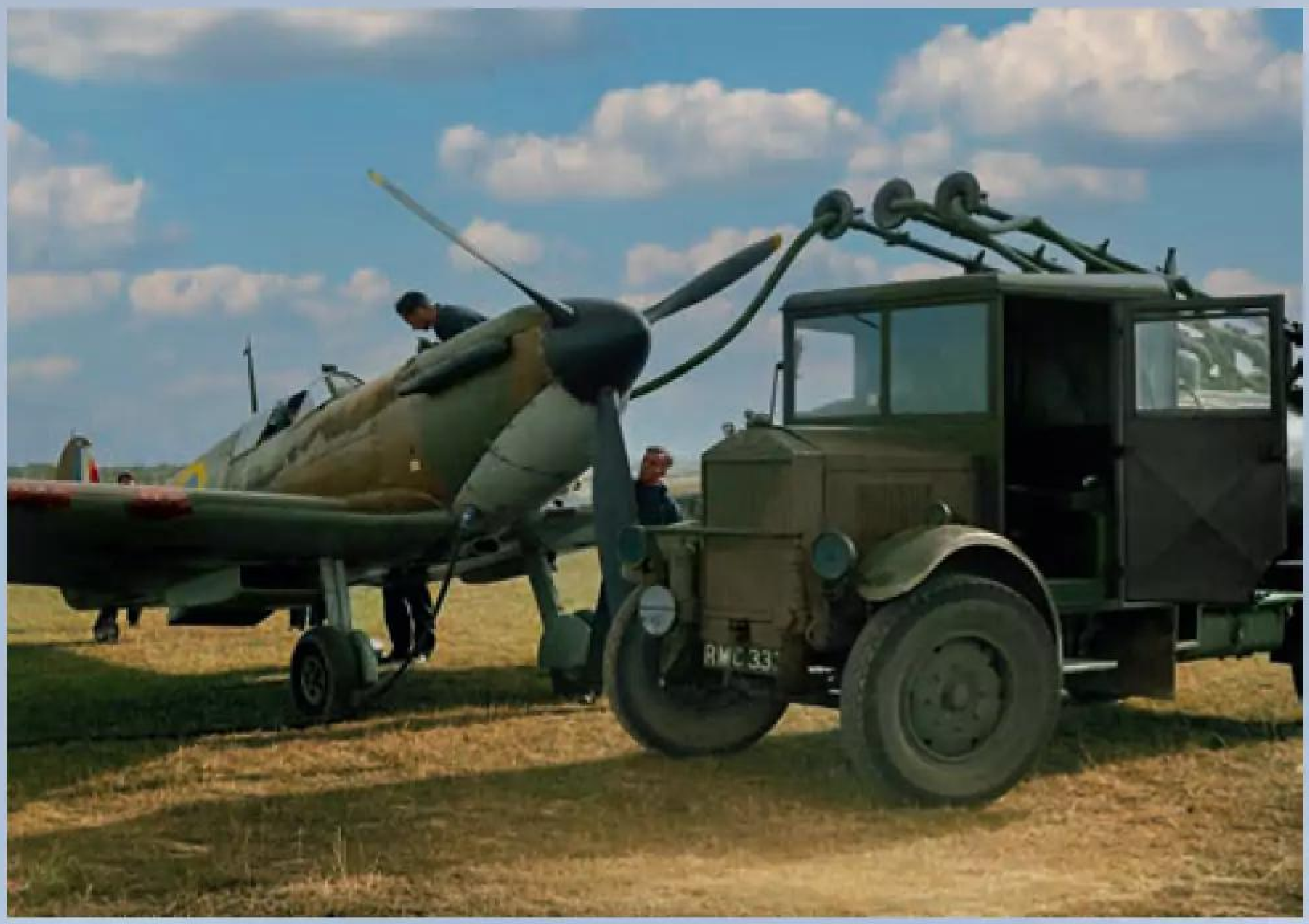
Ground crew running with fuel drums to refuel 6 Squadron RAF Hurricanes in Araxos Greece. *Image: IWM CNA 3199 Public Domain*



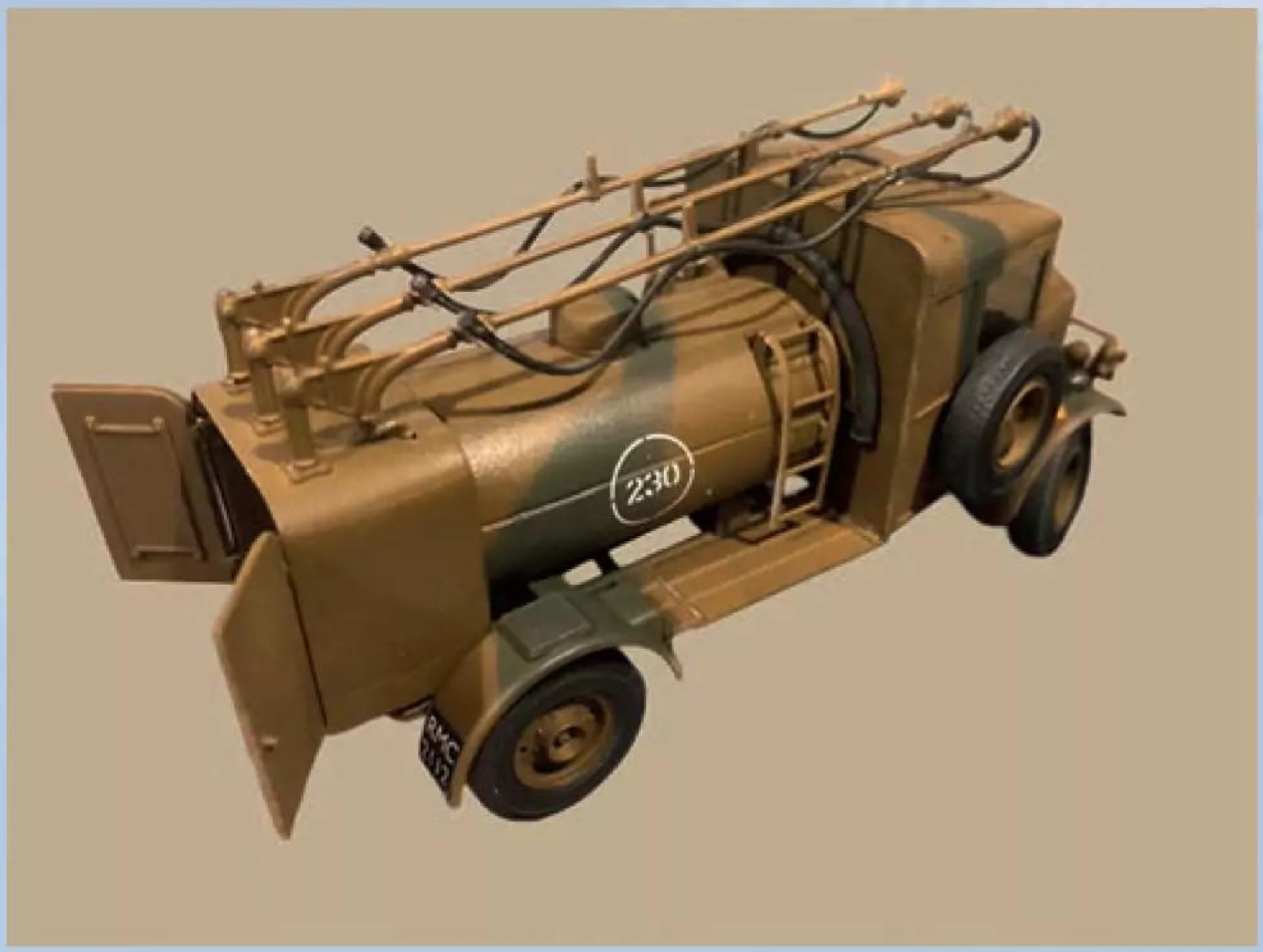
An Albion AM463 three-boom refueller, HHX 647, refuels a Hawker Hurricane P3166 VY-Q, flown by the CO of N° 85 Squadron, S/L Peter Townsend at Castle Camps, July 1940. *Image: Press Agency photographer. IWM HU104490 Public Domain*



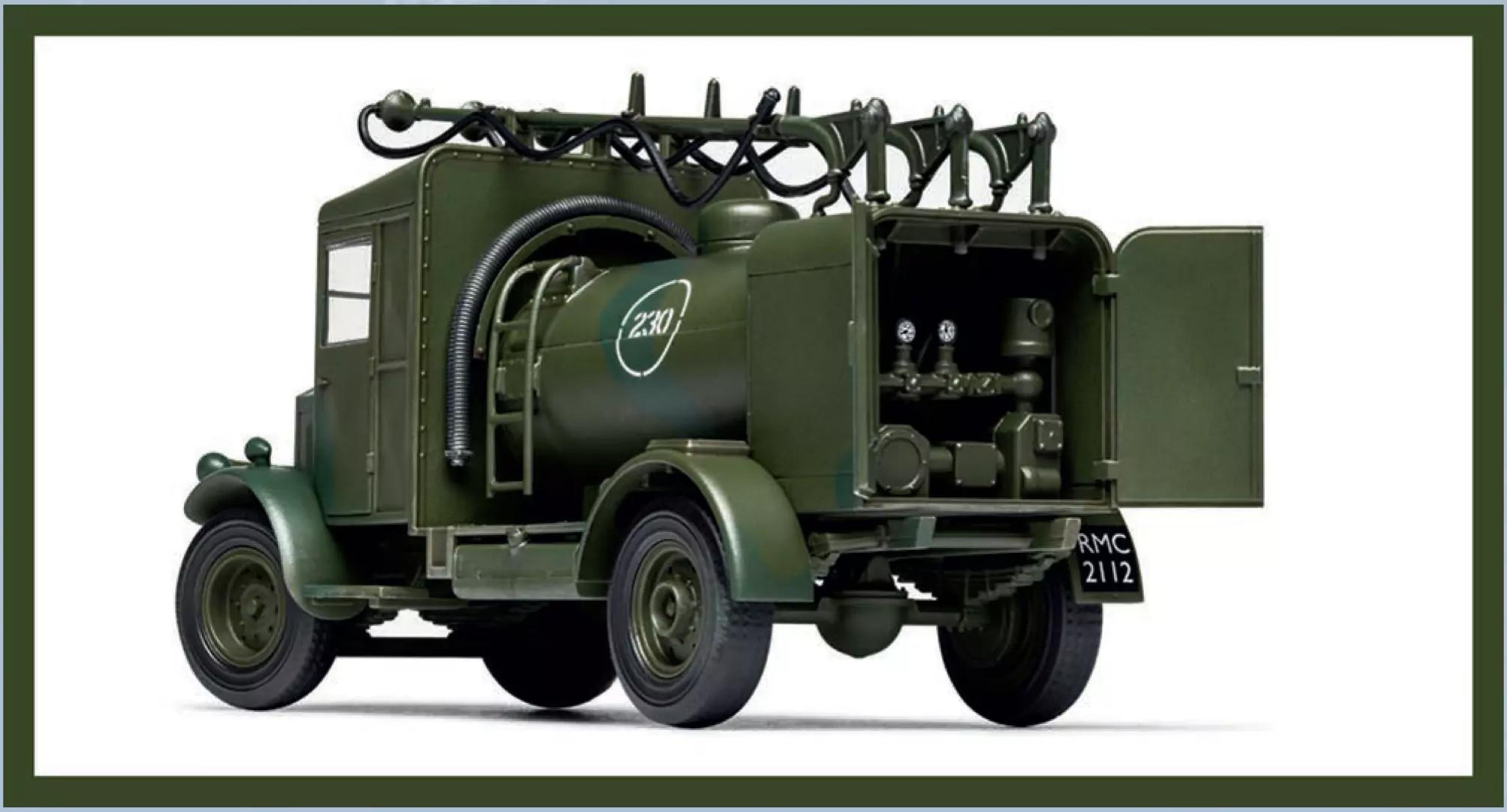
Occupied Jersey. A German Messerschmitt Bf 109 is refuelled from five 50-gallon petrol drums in the back of this ‘impressed’ Commer Q2 dropside lorry, once owned by J. H. Miller. *Image: Bundesarchiv 1011-014A0656-05A Gregor 1940*



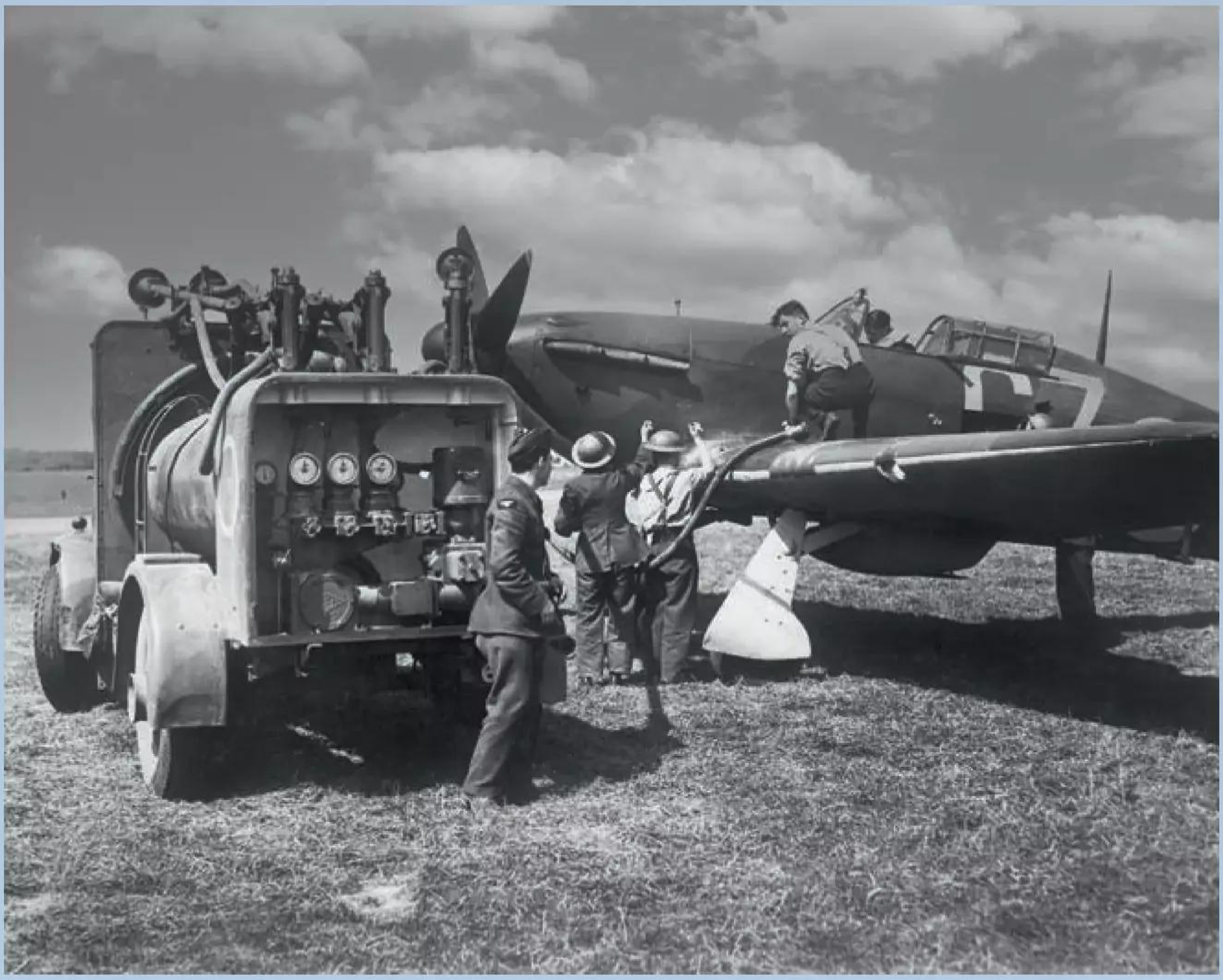
A Spitfire of N° 19 Squadron is refuelled by an Albion AM463 tanker at Fowlmere, near Duxford, September 1940. *Image: Stanley Arthur Devon IWM CH 1372 Public Domain colour creation by Howdi Colour Works*



Dave Brown’s model of an Albion AM463 refueller showing the tri-boom layout on its roof. Dave is an enthusiastic aviation modeller from Ypsilanti in Michigan. *Image: Dave Brown@Plane*



An Airfix model of the Albion AM463 refueller in 1/48th scale from the official Airfix model site showing the contents through the open rear doors. *Image courtesy: © Hornby Hobbies Ltd. Airfix is a registered trademark of Hornby Hobbies Ltd.*



Groundcrew are refuelling a Hawker Hurricane Mk I, of N° 32 Squadron, from an Albion AM463 2-ton tanker while the pilot waits in the cockpit, during the Battle of Britain, Biggin Hill, August 1940 at Hawkinge, Kent. The Zwicky fuel supply equipment is clearly seen in the rear compartment. *Image: IWM HU 57450 Public Domain*

cans, as dedicated tankers were still only used by the major suppliers. It was in the 1920s that the company Standard Oil developed underground storage tanks with fuel tankers able to pump from them and deliver to industry, initially in the United States. The service began to take shape in the UK, with larger companies like Pickfords adding it into their commercial supply chain.

The earliest fighters rarely carried more than 50 gallons of fuel, although the formidable Handley Page type O bombers (O/100 and O/400) were an exception, requiring petrol for their twin 130-gallon fuselage reservoirs, which fed a pair of 15-gallon gravity tanks. It gave them a flying time of up to eight hours and a 700 mile range from a pair of Rolls-Royce Eagle V12. One O/400 crashed en route to Egypt in May 1919, killing its crew and nearly ending the lift of T. E. Lawrence, aka Lawrence of Arabia, who escaped but with significant injuries.

As the Royal Air Force developed, one of the earliest wheeled refuellers became a regular sight on airfield images of the thirties. The Albion AM463 was a two-ton, two-wheel drive chassis with an elliptical 450-gallon tank and swinging supply hoses attached to an outer frame, known as a boom refueller. These were probably the best known and certainly the most photographed, but Karrier, Crossley and Morris chassis were also allegedly used, although we haven't come upon any photographs of these…

The Albion chassis, built in Scotstoun in Scotland provided a comfortable ride by having a pair of Gruss air springs attached to the outside of the front axle giving the driver a well-damped, comfortable ride. They had a three-branch boom system attached to

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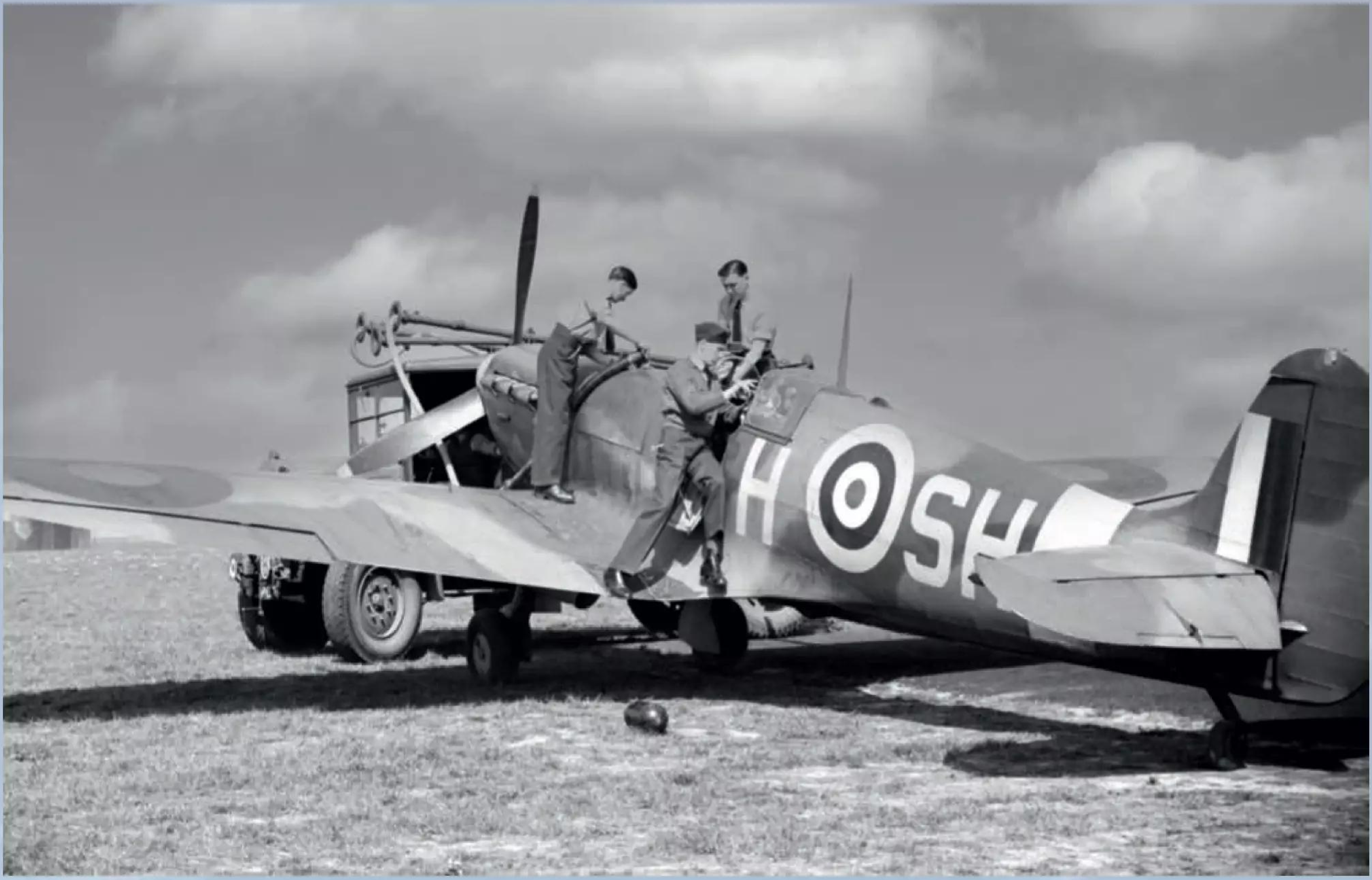
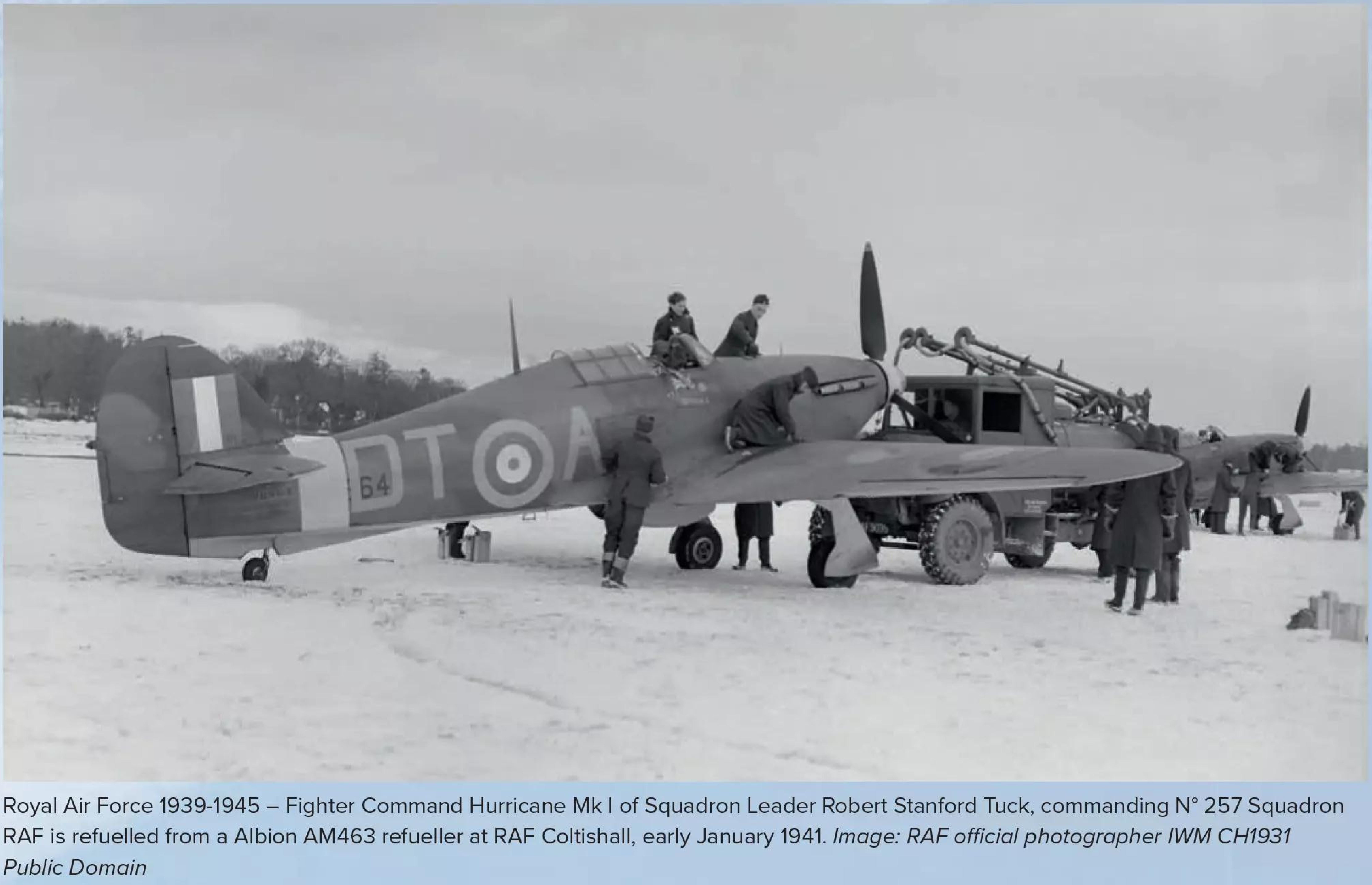


It’s obviously a warm day as shirt sleeves are rolled up, but ties are still worn, as technicians service a Spitfire Mk VB of N° 64 Squadron RAF at Hornchurch, 7 May 1942. The petrol tank filler point is highlighted as the Albion refueller dispenses its load into the aircraft’s tanks. *Image: RAF official photographer. IWM CH 5772 Public Domain*.

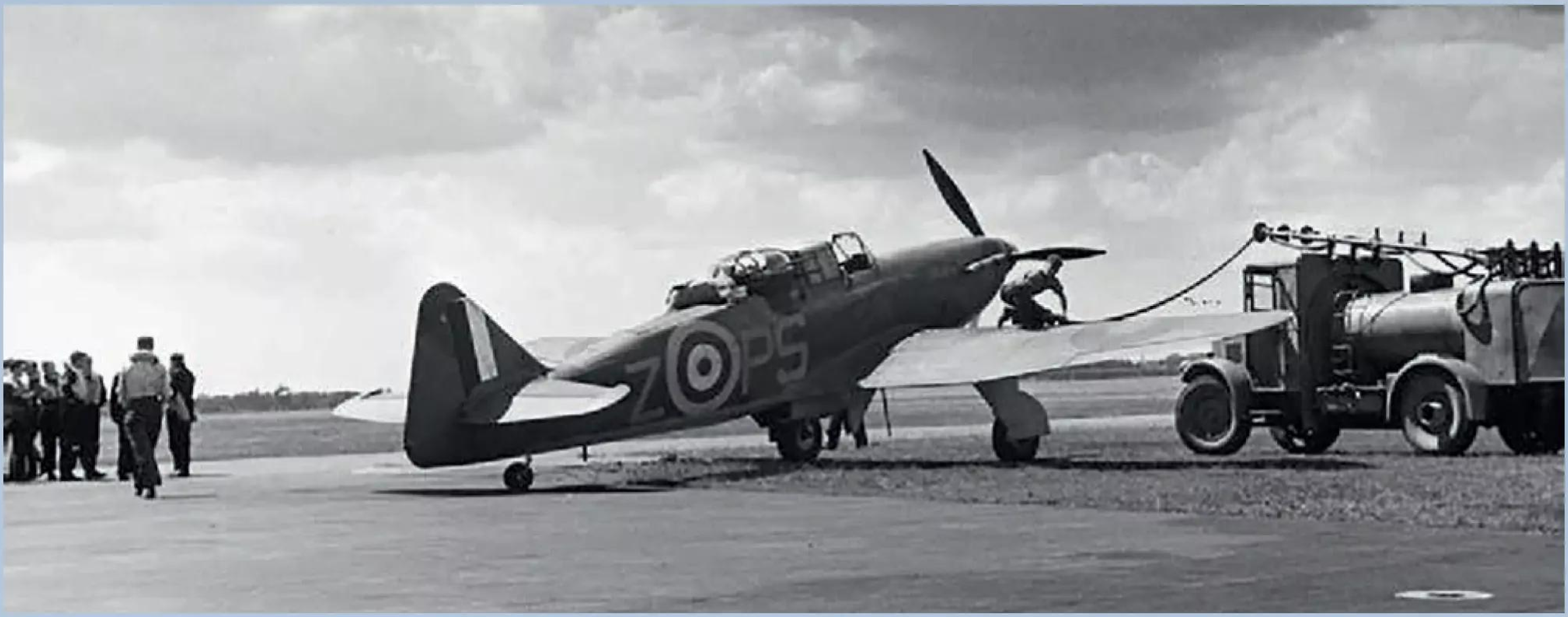


Royal Air Force 1939-1945 – Fighter Command Hurricane Mk I of Squadron Leader Robert Stanford Tuck, commanding N° 257 Squadron RAF is refuelled from a Albion AM463 refueller at RAF Coltishall, early January 1941. *Image: RAF official photographer IWM CH1931 Public Domain*

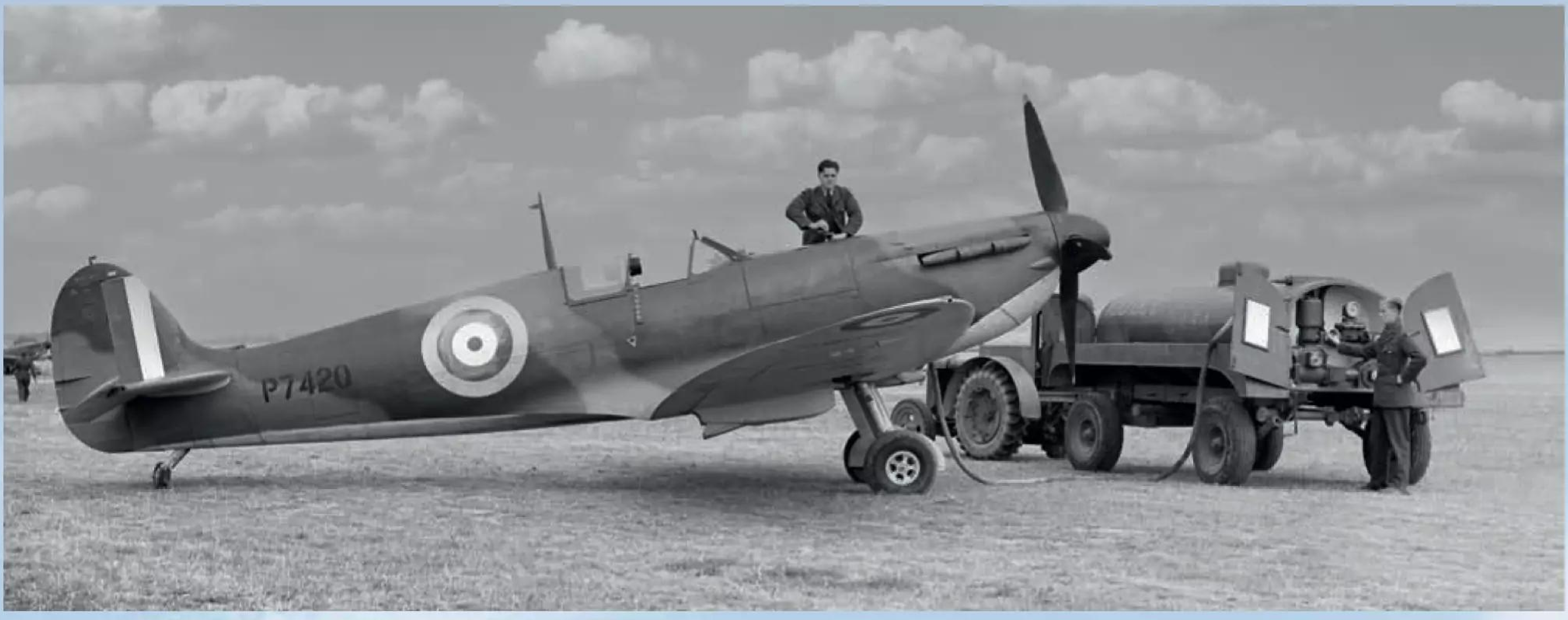
Refuelling a Spitfire Mk VC by RAF ground crew at Ta'Qali, Malta. *Image: IWM CM3214 Public Domain*

their roof (see Dave Brown's model image to appreciate the set-up). This meant that they could, in theory, service three fighters at the same time. However, they were useless in refuelling anything larger, as their hoses only extended to around 20 feet, which would make them incapable of supplying fuel to bombers. Although it has been theorised that the tankers fuelled three fighters at the same time, the length of the delivery hose would prevent this, and we would suggest that the different booms would be fitted to the varying fuel tanks of a single aircraft. The Spitfire had twin tanks while the Hurricane had three.

The Albion AM chassis, potentially named as 'Air Ministry', ordered in a batch of 1,600 (some sources suggest 1,900), were powered by the Albion EN

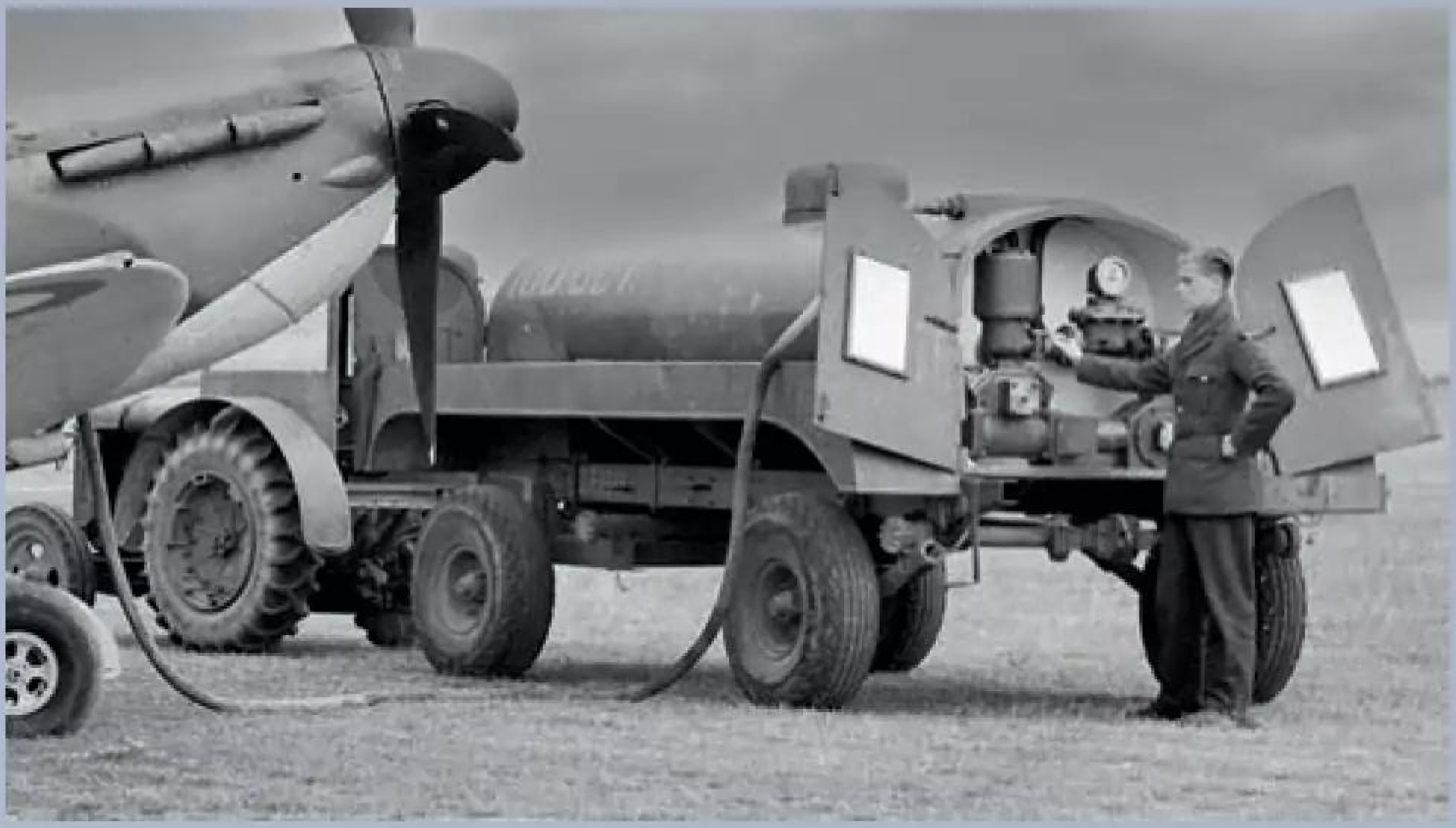


RAF Fighter Command 1940 Boulton Paul Defiant of N° 264 Squadron being refuelled from the ubiquitous Albion AM463 refueller, July 1940. *Image: Press Agency photographer IWM HU 104496 Public Domain*



Groundcrew refuelling a Supermarine Spitfire Mark IIA, P7420, of N° 19 Squadron RAF from a tractor-drawn petrol bowser at Fowlmere, Cambridgeshire. This newly arrived example was one of the few Spitfire Mark II's to fly operationally with a front-line squadron before the end of the Battle of Britain. *Image: Photographer Stanley Arthur Devon – IWM CH 1357 Public Domain*

A model Spitfire being refuelled by a Brockhouse trailer bowser in this detailed diorama at the Northeast Land, Sea & Air Museum, Usworth, Sunderland. *Image: © 2025 Millhouse Archive – Mike & Julie Blenkinsop*



Close-up of the tractor-towed trailer petrol bowser at RAF Fowlmere. *Image: Photographer Stanley Arthur Devon IWM CH1357 Public Domain*

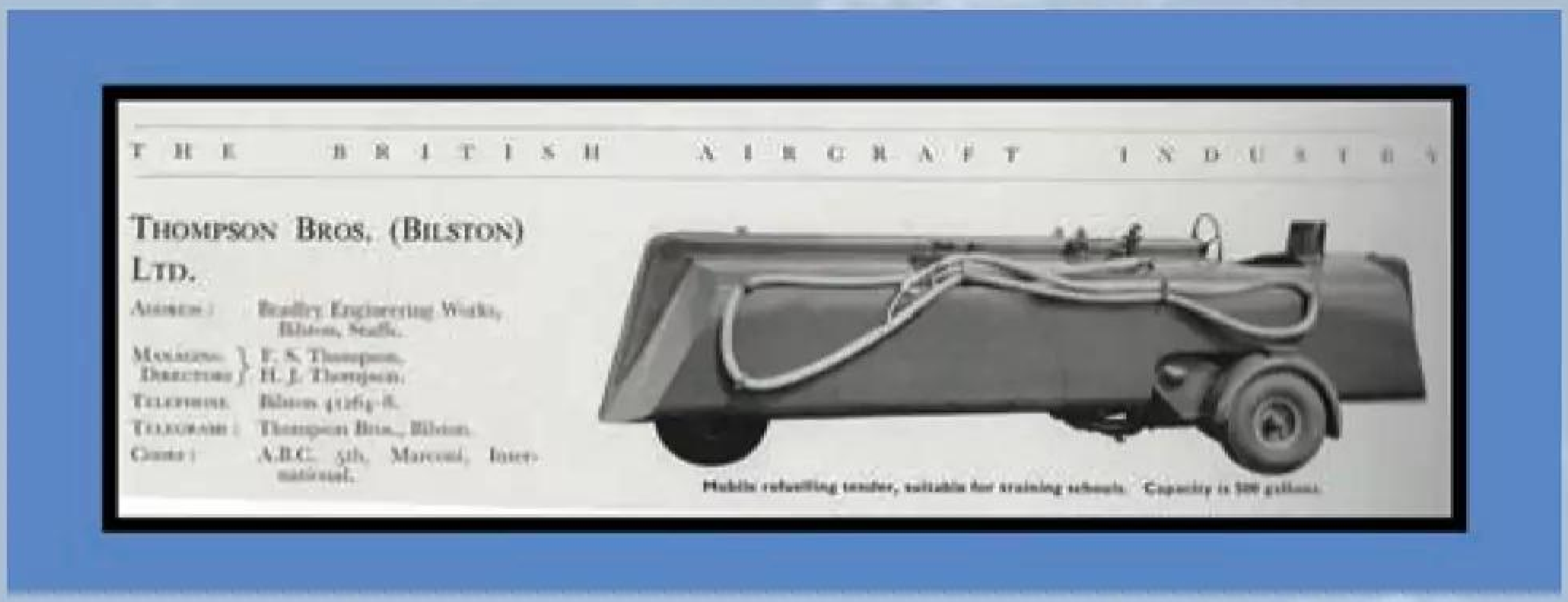
In freezing temperatures, a Boulton Paul Defiant is being refuelled from a trailer petrol bowser in France. *Image: Photographer Stanley Arthur Devon – IWM Public Domain*

Ground crew refuelling a Supermarine Seafire X4652 by petrol bowser, towed in by a Fordson tractor at the Fleet Air Arm airfield at Yeovilton, Somerset. *Image: Royal Navy official photographer, L/T E.A. Zimmerman IWM TR1275 Public Domain*

In Araxos in Greece, ground crew manhandle 50-gallon petrol drums to refuel N° 6 Squadron RAF Hurricanes. *Image: IWM CNA 3199 Public Domain*

213 or 217 petrol engine of 4.42 or 3.89 litres respectively and were introduced in 1934. However, initially, it appears the whole design was specifically dedicated to Royal Air Force use. Four hundred were commissioned as refuellers while the others were built as ambulances, crew coaches, cranes and general service tenders; 'tender' being the RAF term for a light cargo truck. Many went to France with the BEF (British Expeditionary Force) never to return, some being commandeered by the German Heer, part of the Wehrmacht.

There was little in the way of crew comfort, only a covered, basic cab for long hours out on the airfield in the winter weather, but they did have the great advantage of electric self-starting as the old crank handle had gone. The Albion was replacing the old, worn-out Crossley and Leyland of WW1 vintage and was unusual in carrying its spare wheel on the driver's door. The rear pump was Zwicky equipment, while the crane version on the same chassis ➤



THE BRITISH AIRCRAFT INDUSTRY

THOMPSON BROS. (BILSTON) LTD.

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Telephone: Bilston 41264-8.
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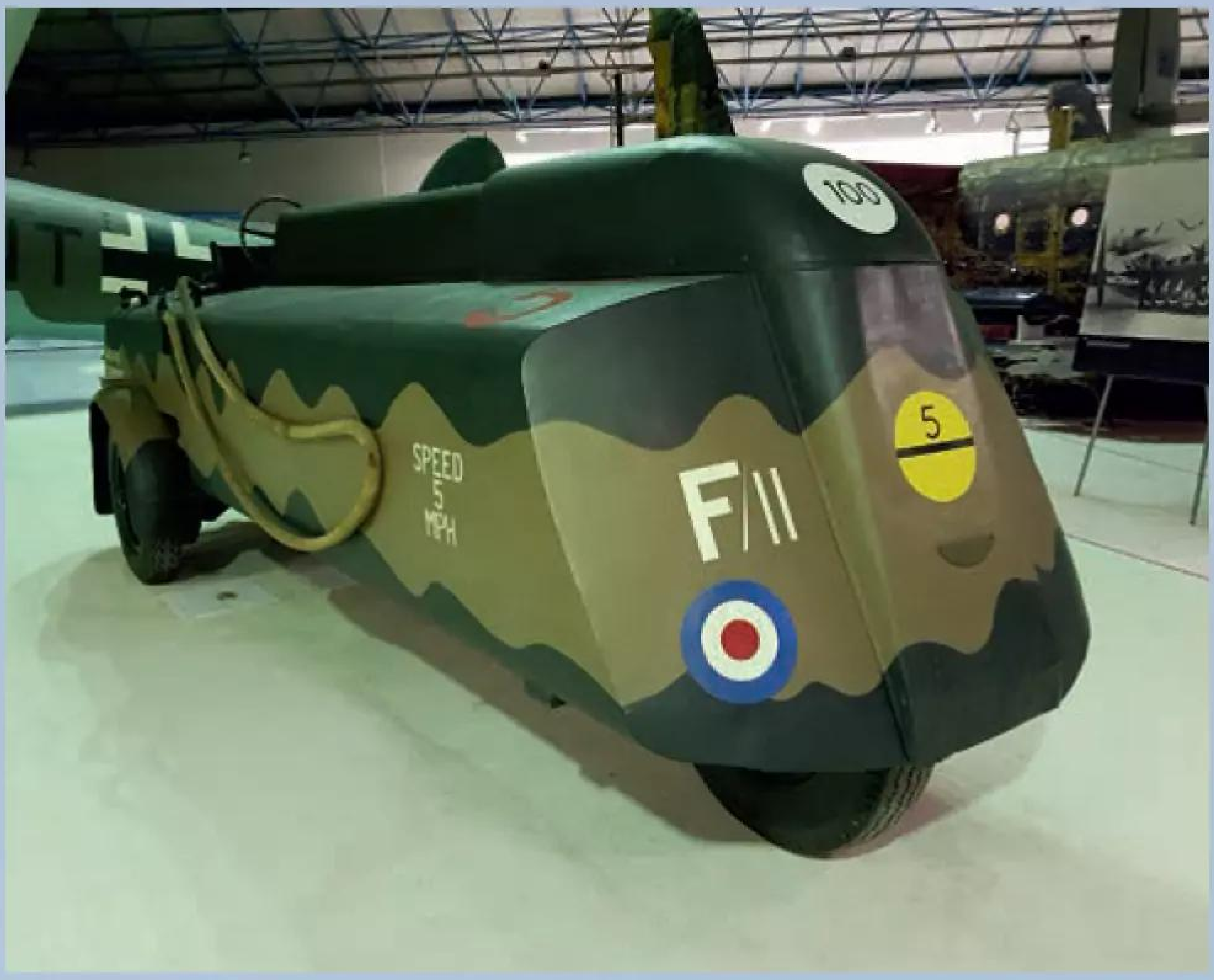
Mobile refuelling tender, suitable for training schools. Capacity is 500 gallons.

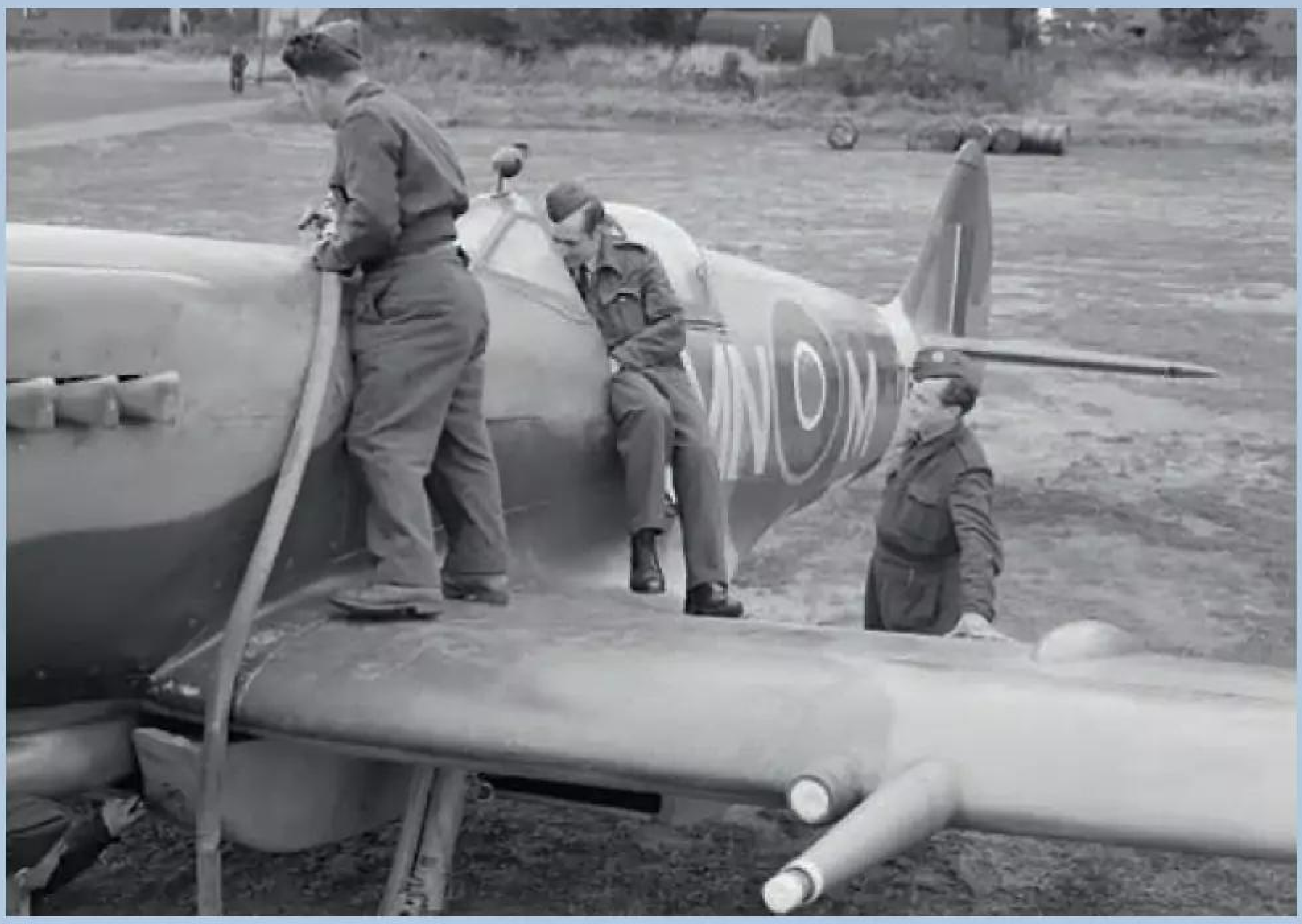
A Thompson Refueller sales brochure. *Image: Millhouse Archive – Mike & Julie Blenkinsop*

A Thompson refueller awaits its next action on a French Mosquito squadron base. *Image: Wiki Public Domain*



Thompson Refueller Mk V preserved in the RAF museum at Hendon. *Image: Wikipedia Ind-escent134057 cc-by-SA 2.0*

Supermarine Spitfire LF Mark VIII, JG253 was the personal aircraft of Group Captain H. G. Goddard, Commanding Officer of N° 906 Wing RAF, being serviced and refuelled at Tabingaung, Burma. Behind this aircraft are parked other Spitfire LF Mark VIIIs, belonging to N° 155 Squadron RAF, detached from Tulihal to assist in operations in support of the 14th Army. *Image: P/O Ashley RAF official photographer IWM CF 269 Public Domain*

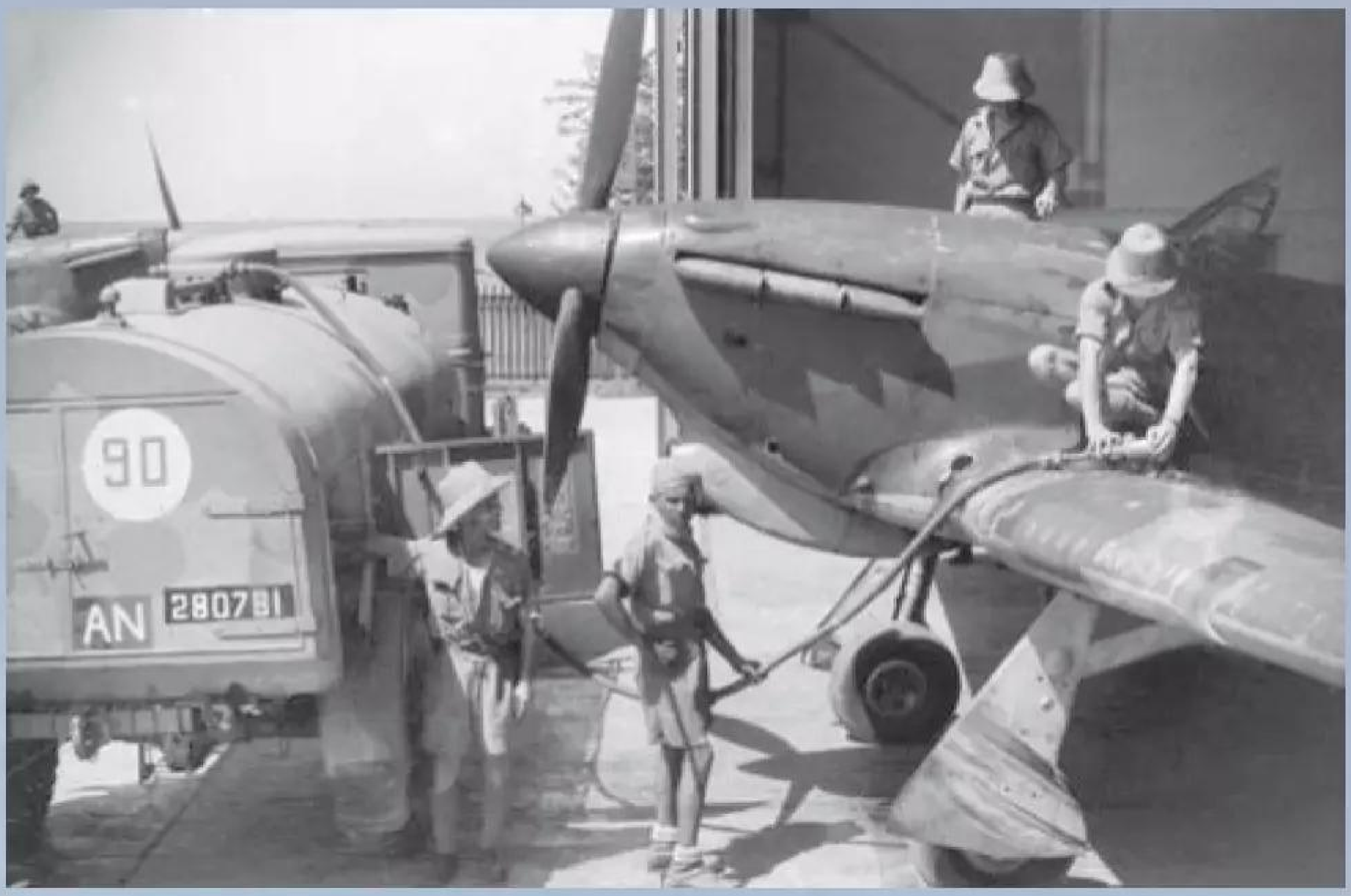


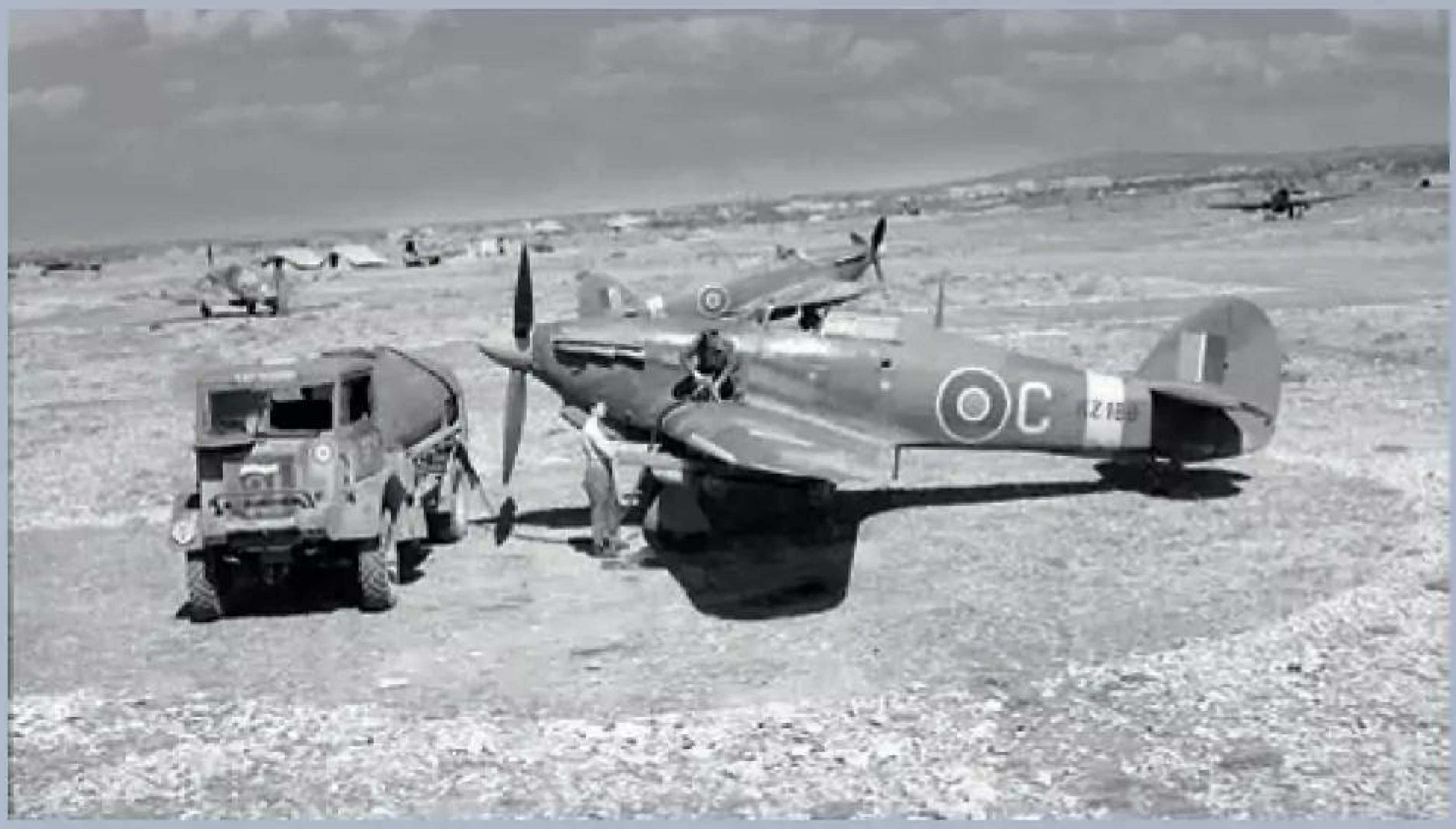
A Belgian ground crew refuelling Supermarine Spitfire Mark XIVE, RM764 'MN-M', of N° 350 (Belgian) Squadron RAF at Lympne, Kent. This image clearly shows the petrol cap location directly in front of the pilot. *Image: IWM CL1360 Public Domain*

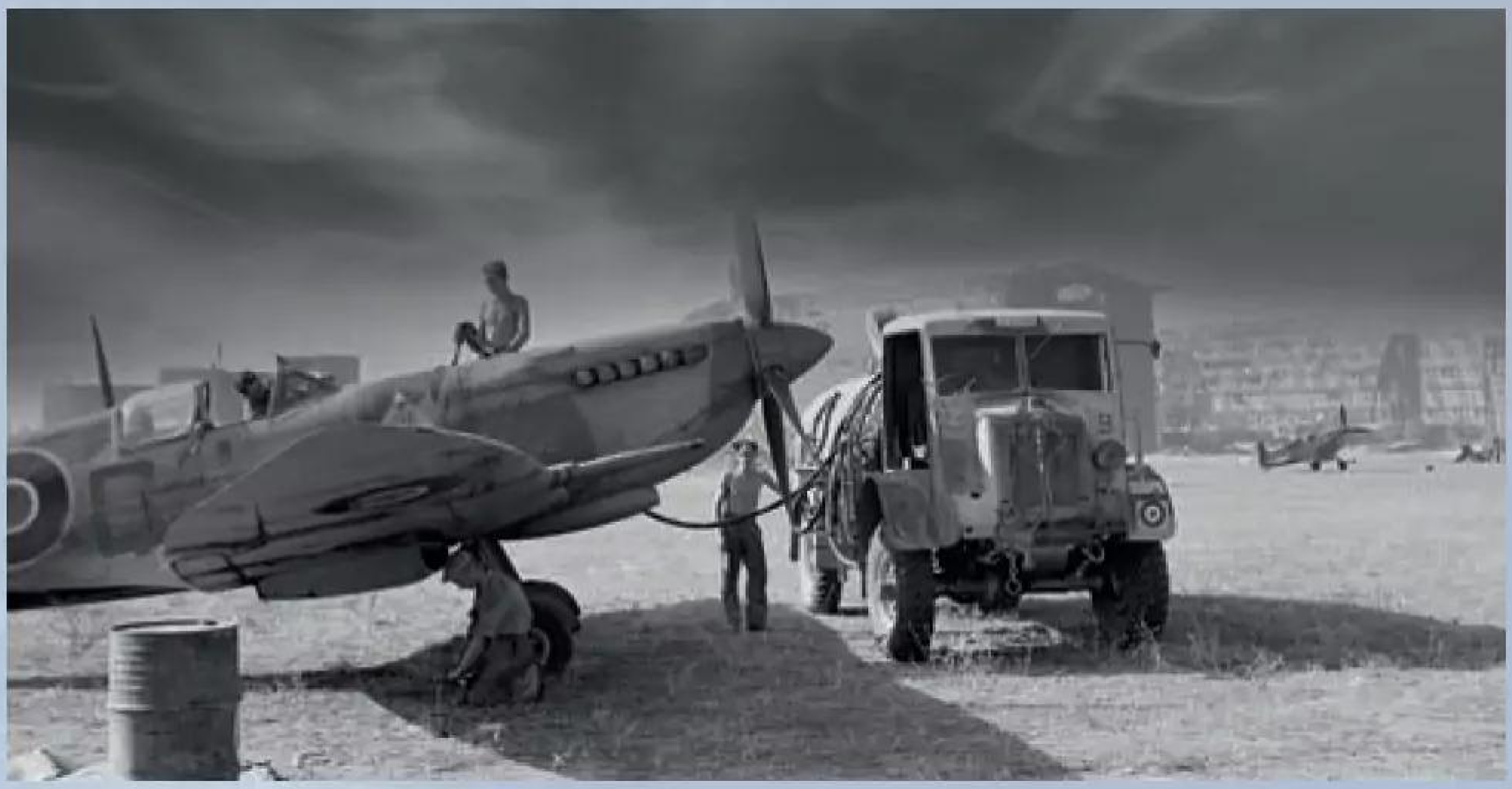
A DeHavilland Mosquito Mk II of N° 157 Squadron is refuelled from a Bedford QL 950-gallon tanker at Hunsdon on 16 June 1943. *Image: IWM CH10312 Public Domain*

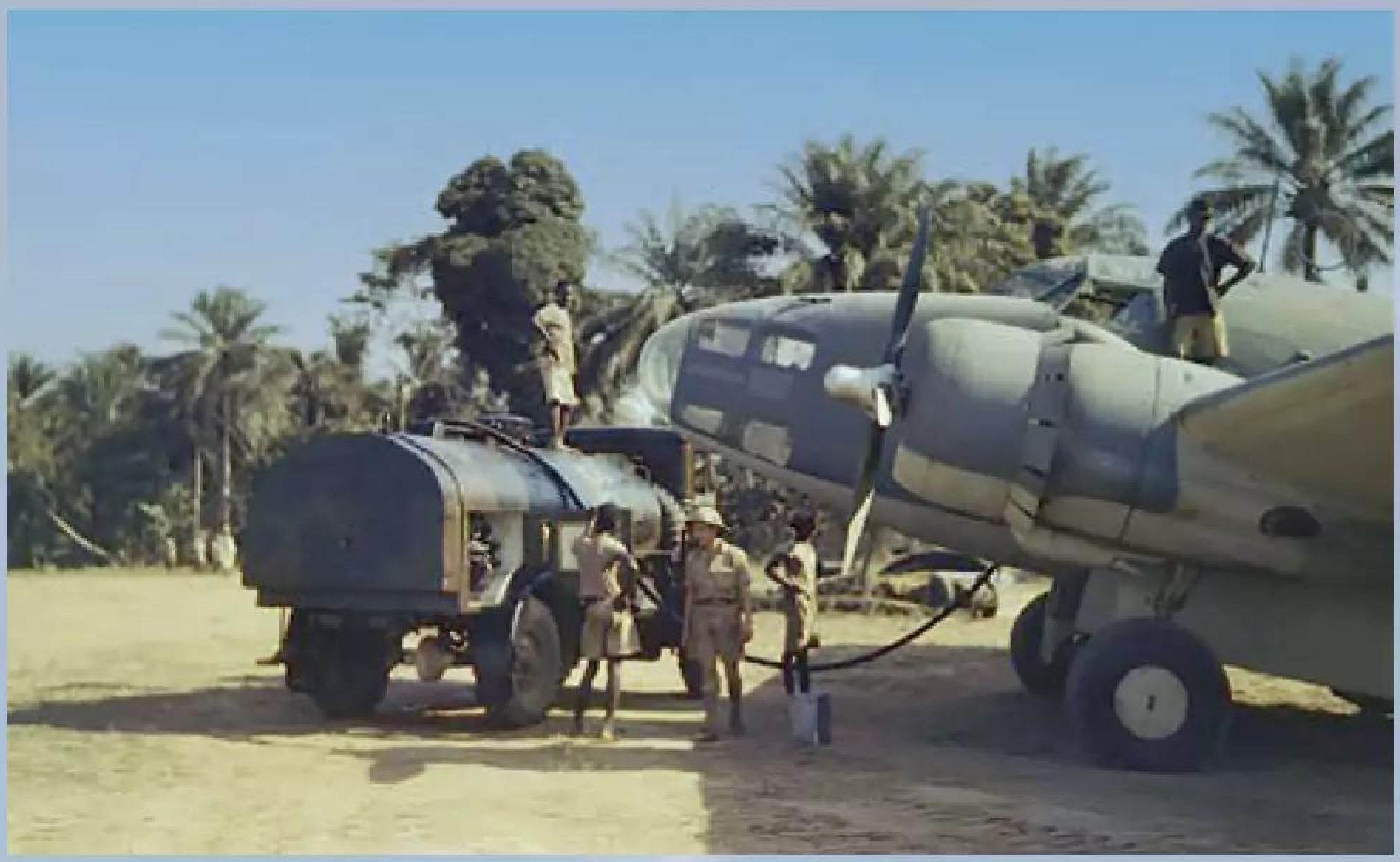
was furnished with a Ransome Rapier crane. The tankers would be marked with a number within a circle, usually either 224 or 230. This number was a code from the Directorate of Technical Development referring to the contents of the tank, 224 was 77 octane fuel while 230 was 87. After its discovery another circle would also appear showing 100, denoting the tanker was charged with 100 octane. These numbers became obsolete in April 1986 when NATO designations like AVGAS and AVTUR became the standard.

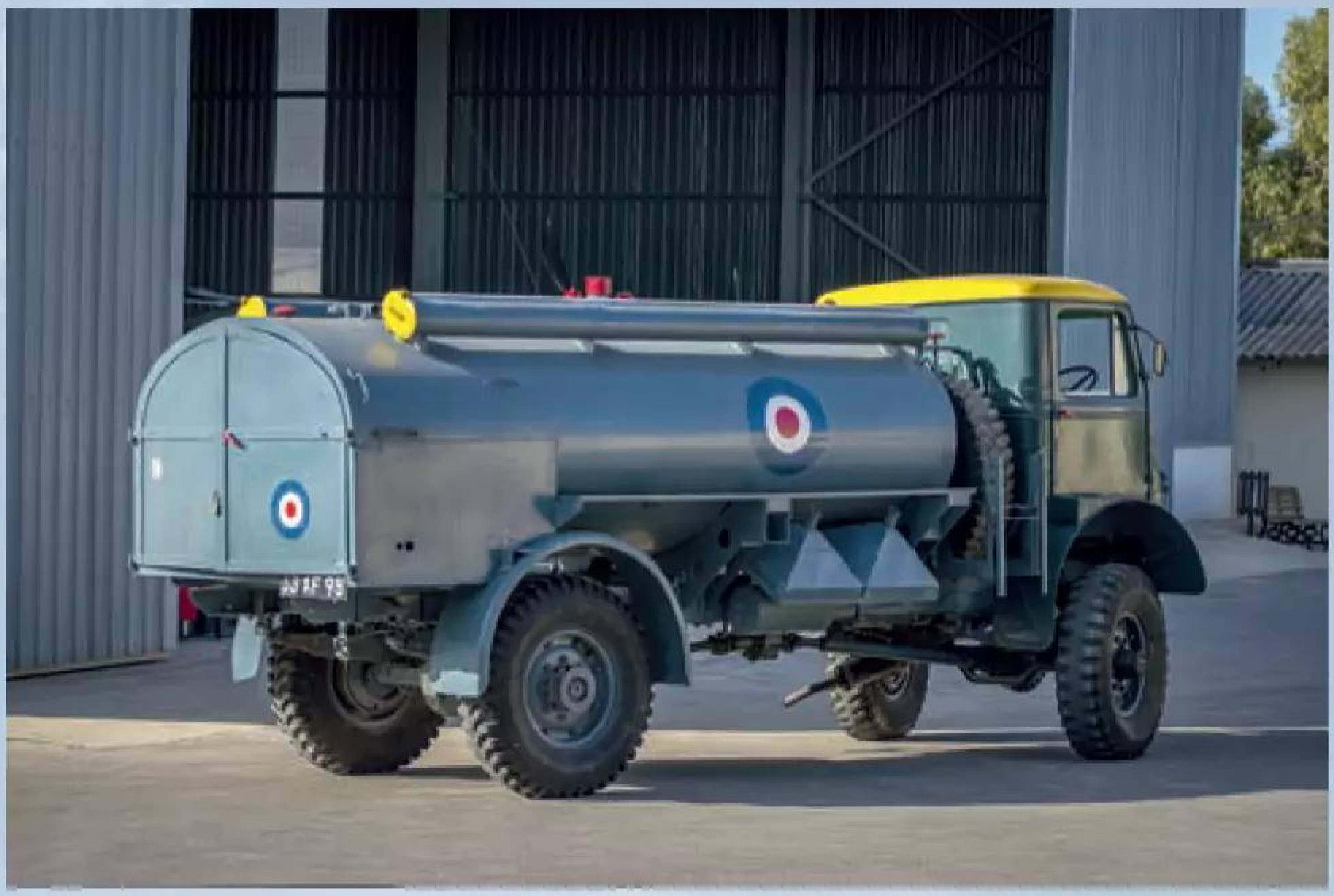
While a vehicle would be occupied during the transfer of fuel, it became obvious from a logistical point of view, that a trailer with its own pumping equipment could be towed on-site and deliver fuel on its own, using an in-built pump. A Fordson model N tractor could bring the bowser in and leave it next to the aircraft for the refuelling team, cutting down the use of a motorised tanker, although safety factors suggested that where possible the bowser should remain attached to its prime mover in case of an emergency. The towed bowsers were built by Brockhouse, probably with tanks by Butterfields. They had opening doors in

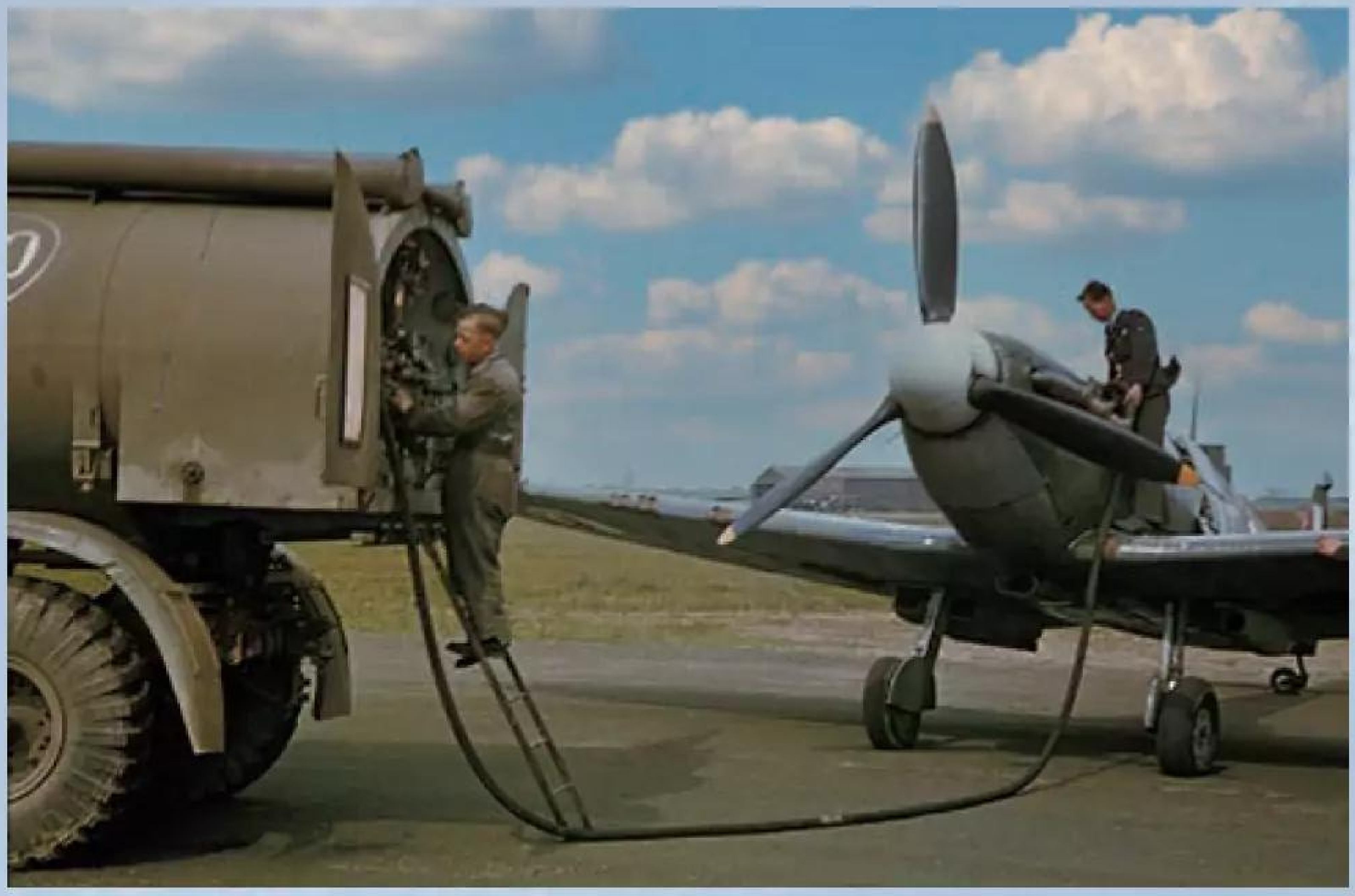

A clear view of the Bedford QL with rear doors closed while refuelling a Hawker Hurricane in foreign climes. *Image: IWM C1438 Public Domain*


Hurricane Mark IV, KZ188 of N° 6 Squadron RAF being refuelled by a QL 950-gallon tanker, amid other aircraft of the squadron, on a dispersal at Prkos, Yugoslavia. *Image: IWM CL3480 Public Domain*


Supermarine Spitfire HF Mark VIII of No. 92 Squadron RAF, undergoing routine maintenance at Grottaglie, Italy, refuelling from a Bedford QL fuel tender. *Image: F/O B. Bridge RAF official photographer IWM CNA 1470 Public Domain*


Local workers help to refuel a Lockheed Hudson aircraft with 100-octane fuel using a Bedford QL petrol bowser in West Africa, 1943. *Image: IWM TR747 Public Domain*


A fine view of an early version of the Bedford QL refueller, 53 AF 98 outside the Ta'Qali Aviation Museum, Malta. *Image: Roy Polidano, Director Malta Aviation Museum*


Ground crewmen operating a 'Matador' 6-wheeled 2,500-gallon tanker refuel a Supermarine Spitfire Mark II at an Operational Training Unit in 1942. *Image: RAF official photographer IWM TR14 Public Domain*

each end for access to pumping equipment and mechanicals. Believed to be powered by a Lister engine, it is suggested that over 10,000 were made during the Second World War but the independently sprung torsion chassis was used for other applications too. At twenty feet long, they were manufactured at a cost of a few pence short of £455!

From 1935, a new shape had begun to appear on the airfield, the Thompson three-wheeled refueller. Driven from the rear of the chassis from a single seat, the Thompson was a large tank, covered over with a dynamic streamlined bodywork, powered by a Ford car 10hp engine. It was restricted to 5mph and the fuel delivery hoses were strung along its bodywork length, later models used a J.A.P. 8hp engine. The Bilston company of Thompson Brothers became heavily involved in tank production for the Military, they had put tanker bodies on lorry chassis back in 1928. They had then developed the dedicated three-wheeler, progressing to the Mark V, holding

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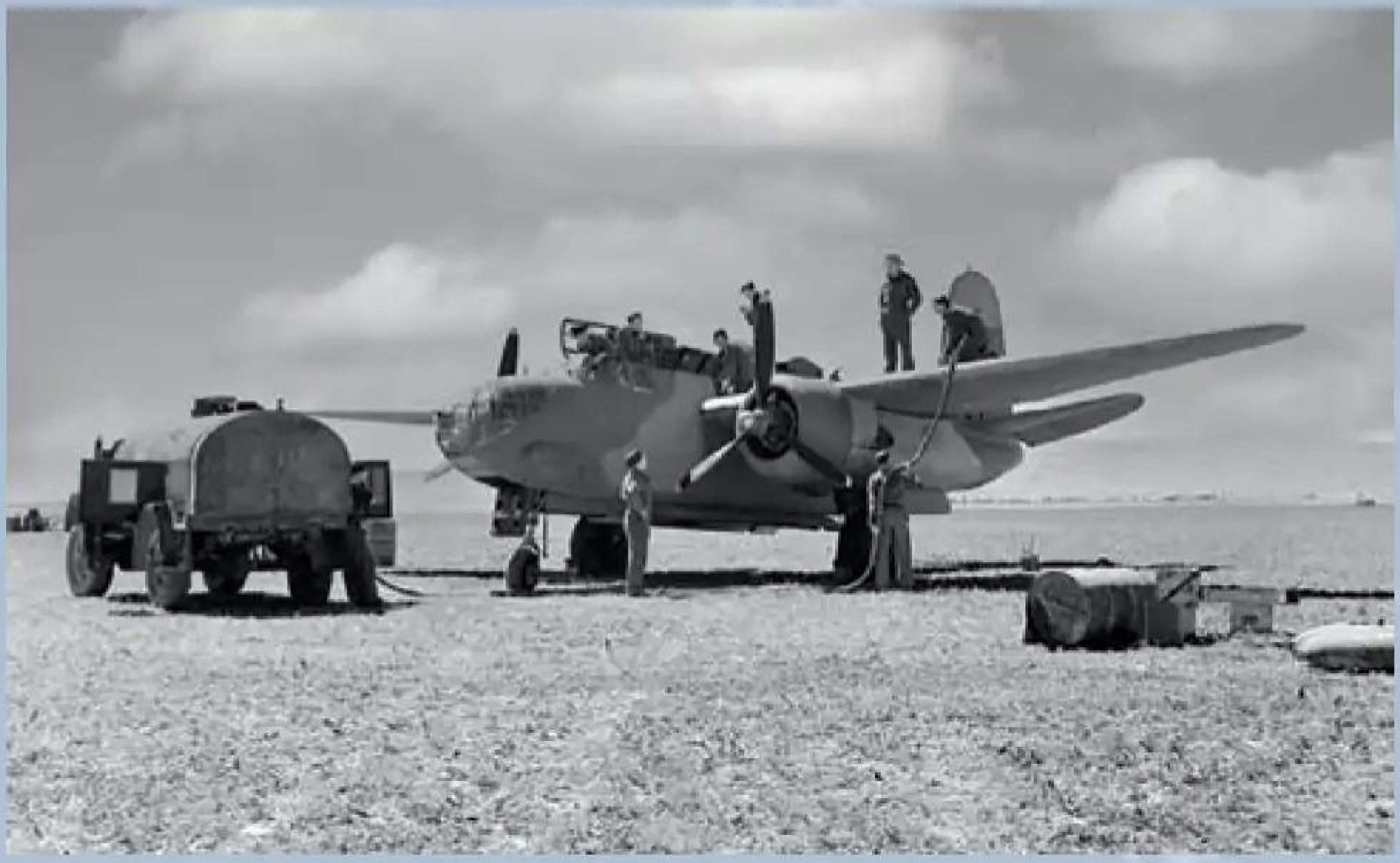
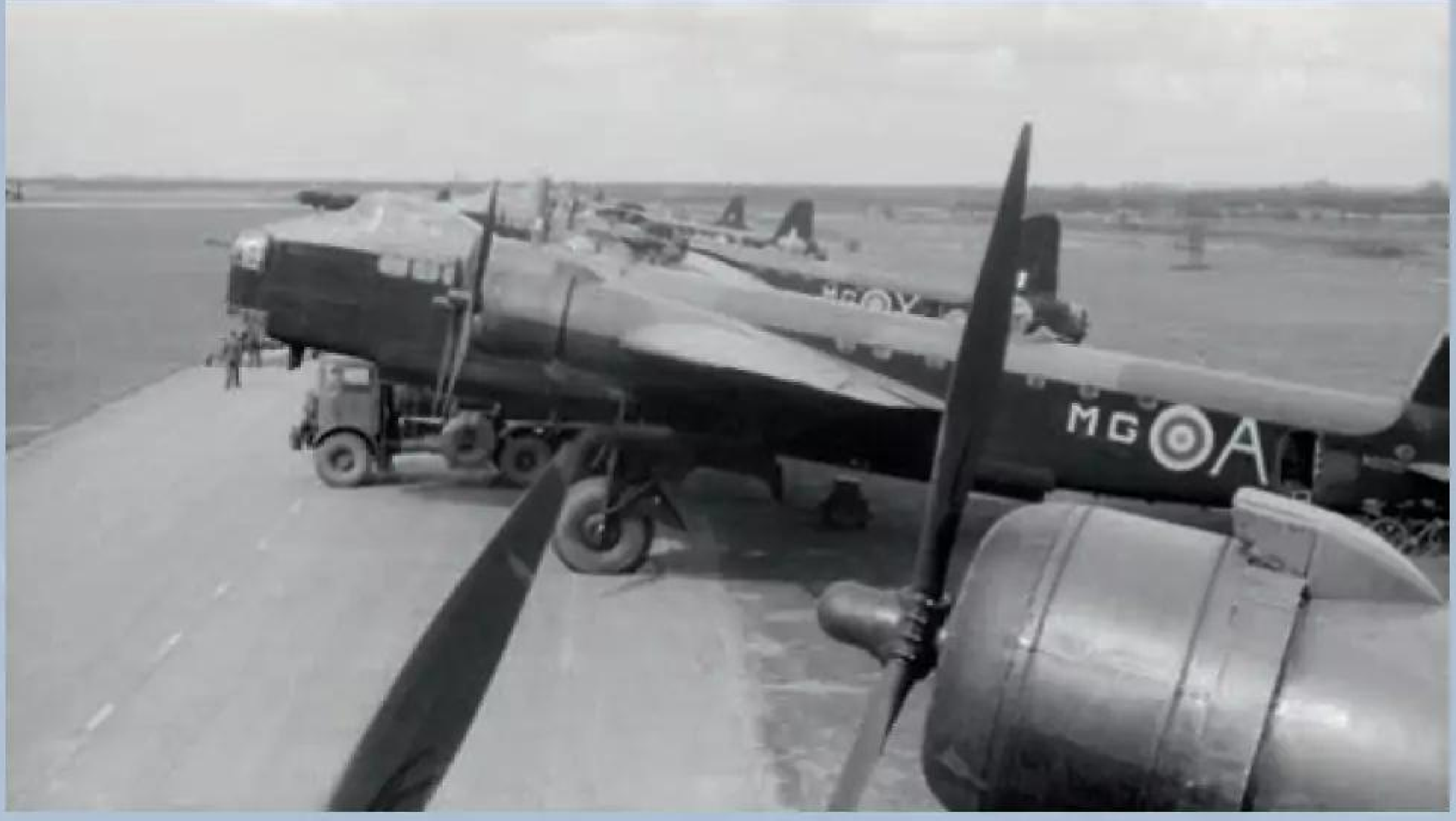
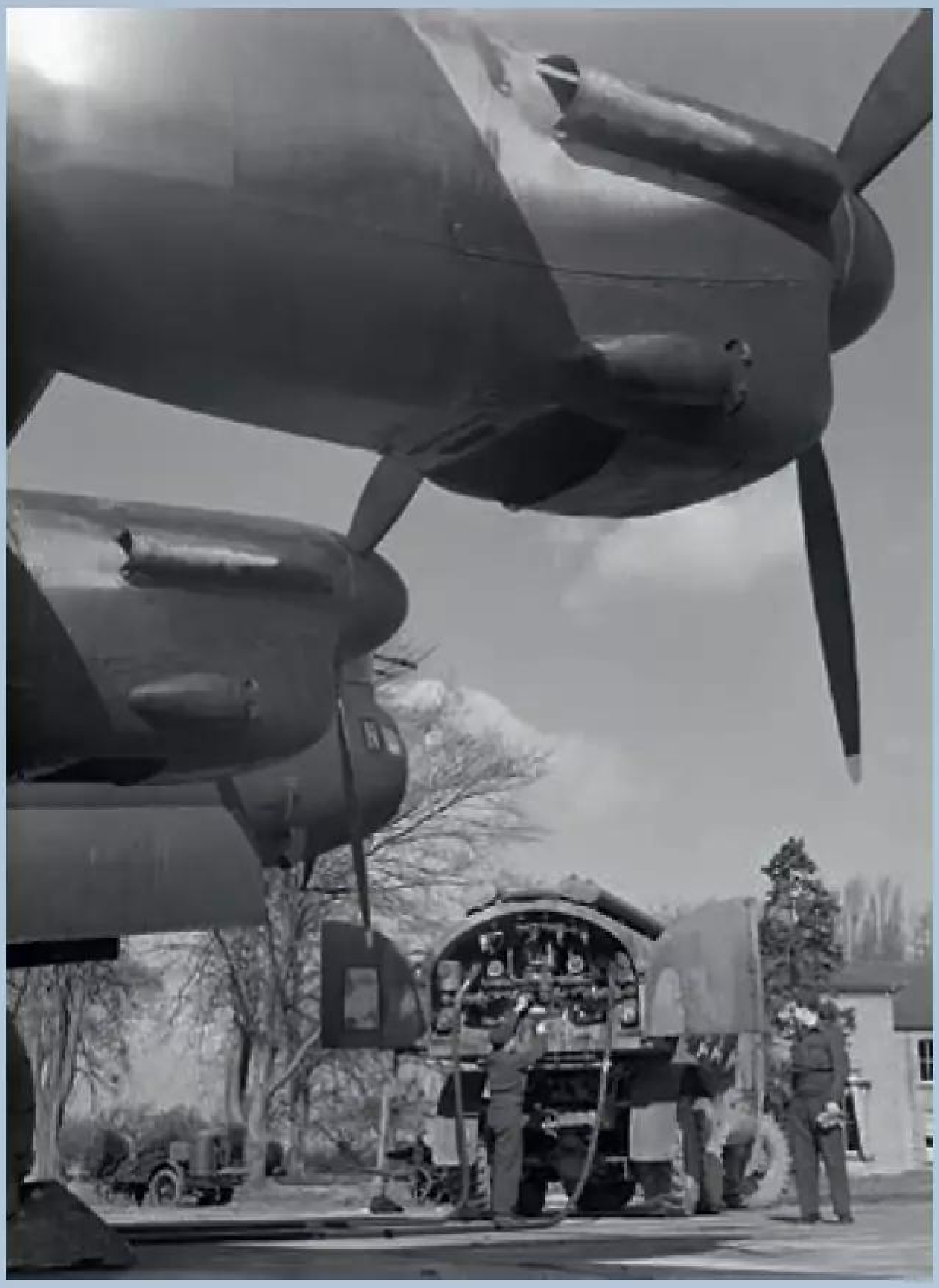


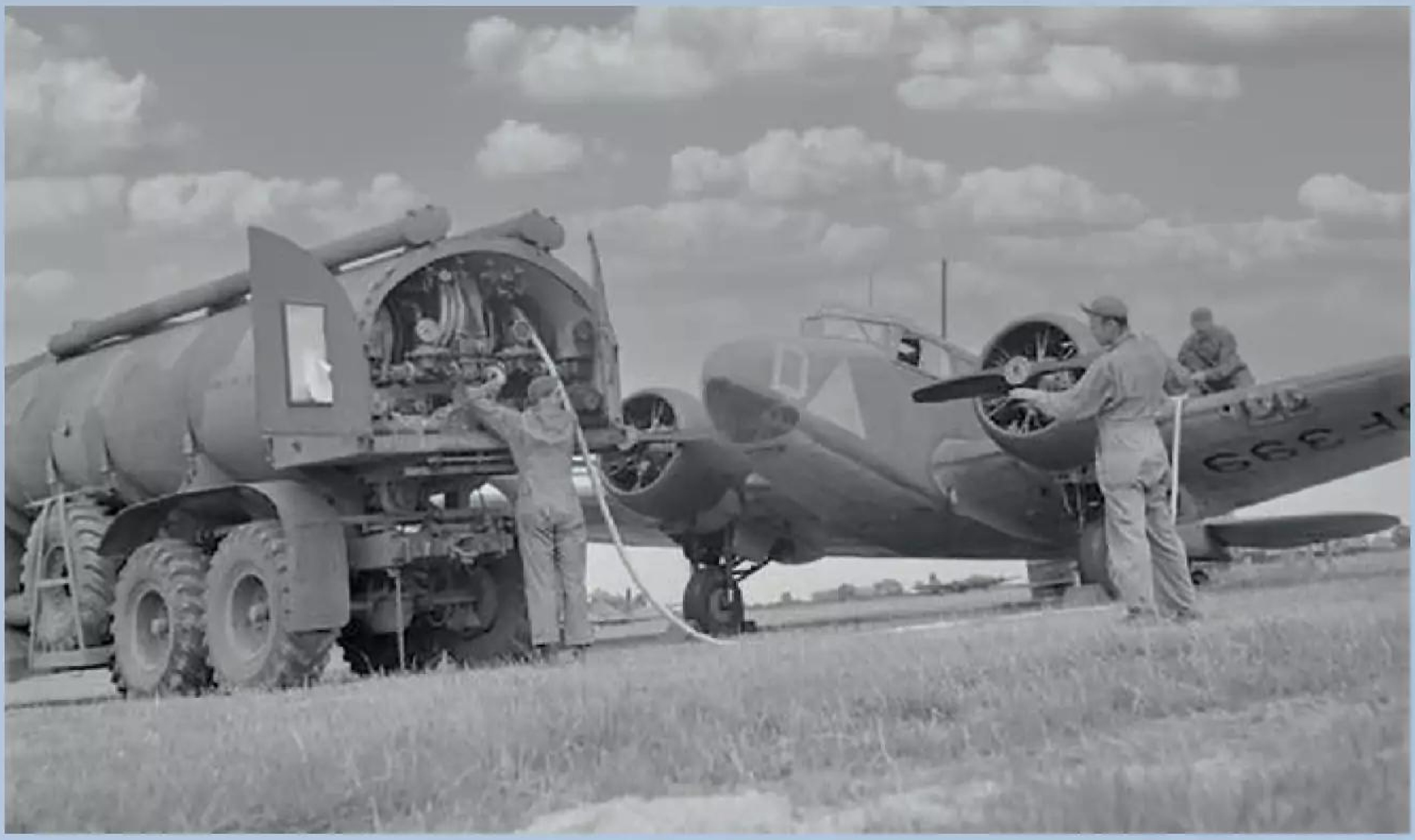
A Douglas Boston Mark III, AL740, of N° 114 Squadron RAF, is refuelled for a further operation at Canrobert, Algeria 1943. Image: F/O F.J. Brock, *RAF official photographer IWM CNA 578 Public Domain*



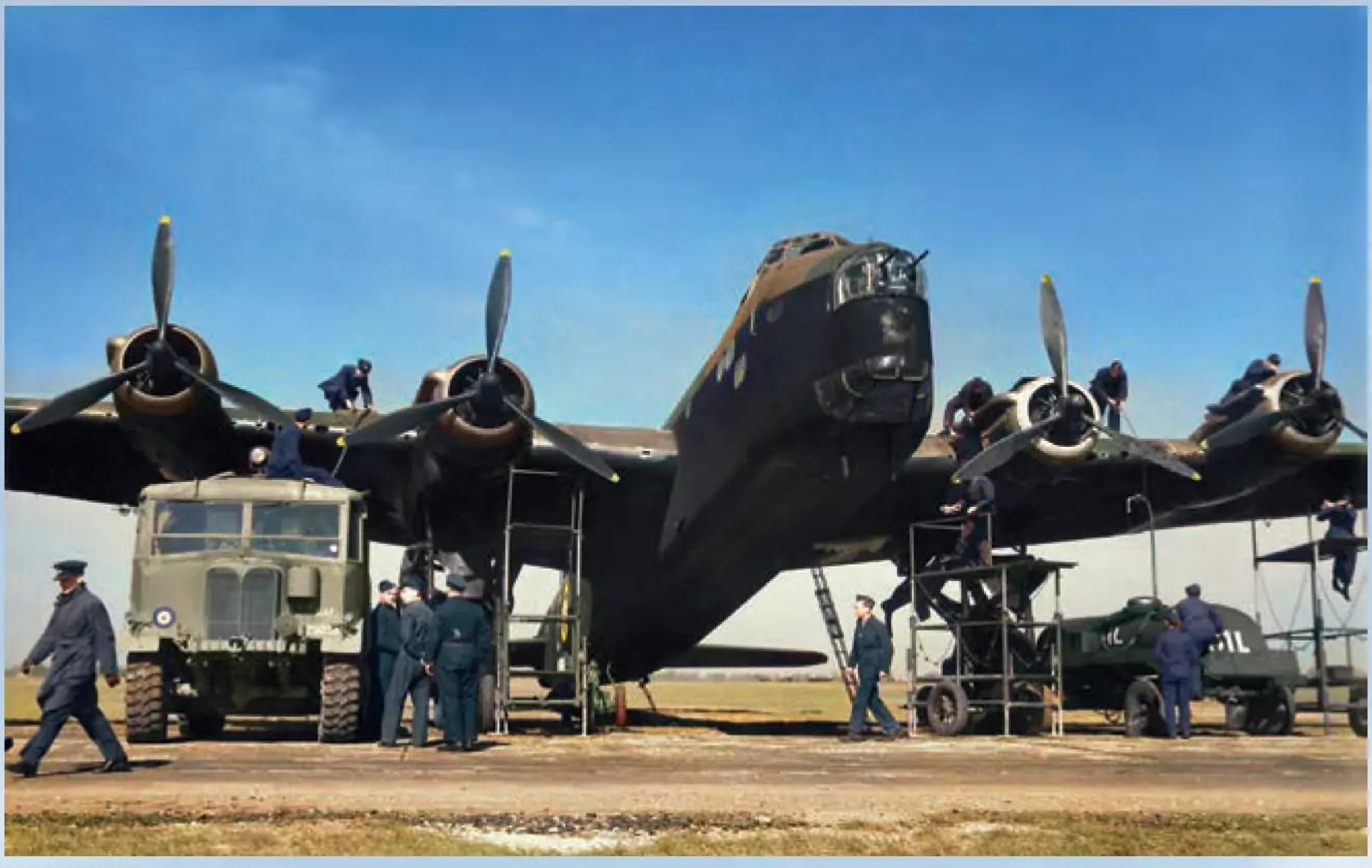
A Matador 2,500-gallon refueller is dwarfed by a squadron of Stirling B Mark I bombers of N° 7 Squadron while being refuelled on the flight line at Oakington, Cambridgeshire, prior to a night raid on Dortmund, 15 April 1942. *Image F/O F. J. Brock RAF official photographer IWM CH 5282 Public Domain*



Interestingly, quite a stretch for this refueller technician as he connects fuel lines to replenish Avro Lancaster B Mark III, ND560 'DX-N', of N° 57 Squadron RAF at East Kirkby, Lincolnshire, in preparation for a night attack on the railway yards at La Chapelle, France. *Image: F/O Forward RAF official photographer IWM 12868 Public Domain*



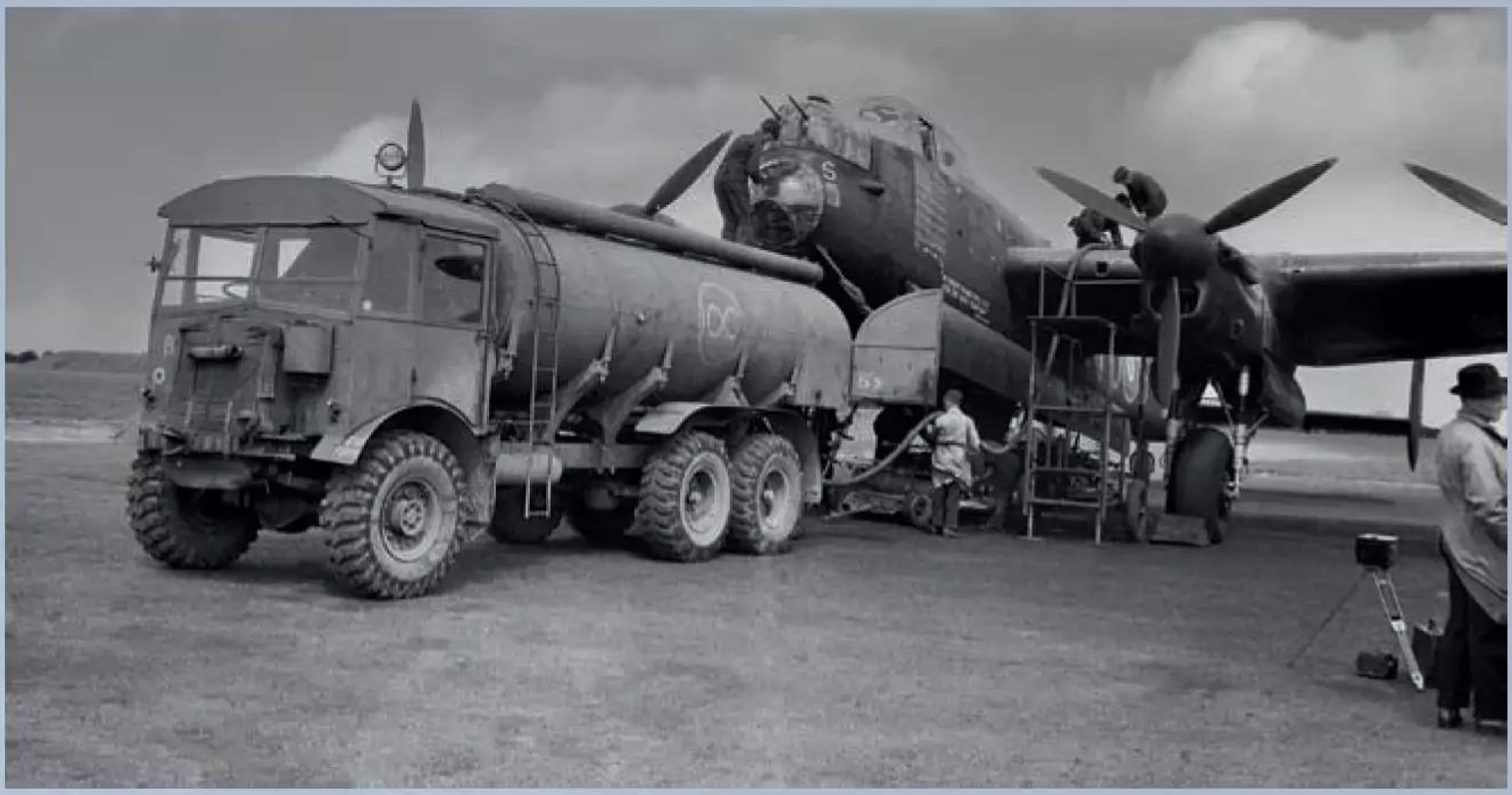
American aircrew refuel an Airspeed Oxford training aircraft at an American air force base 'somewhere' in England in 1943, using a British RAF AEC 'Matador' 6 x 6, 2,500-gallon refueller. *Image: IWM D15130 Public Domain*



A Short Stirling of N° 1651 HCU (Heavy Conversion Unit) is being refuelled by an AEC 'Matador' 6 x 6 refueller (left) while a trailer bowser replenishes the oil at Waterbeach in 1942. *Image: IWM HU 107753 Public Domain colour creation by Howdi Colour Works*

500 gallons of fuel in two separate tanks of 250 gallons and 50 gallons of oil; it was used extensively by the RAF. The pumps were designed and manufactured in-house. They survived into the 1970s with two of them still working into the 1990s at North Weald and Leicester East stations; there are estimated to be 20 survivors worldwide.

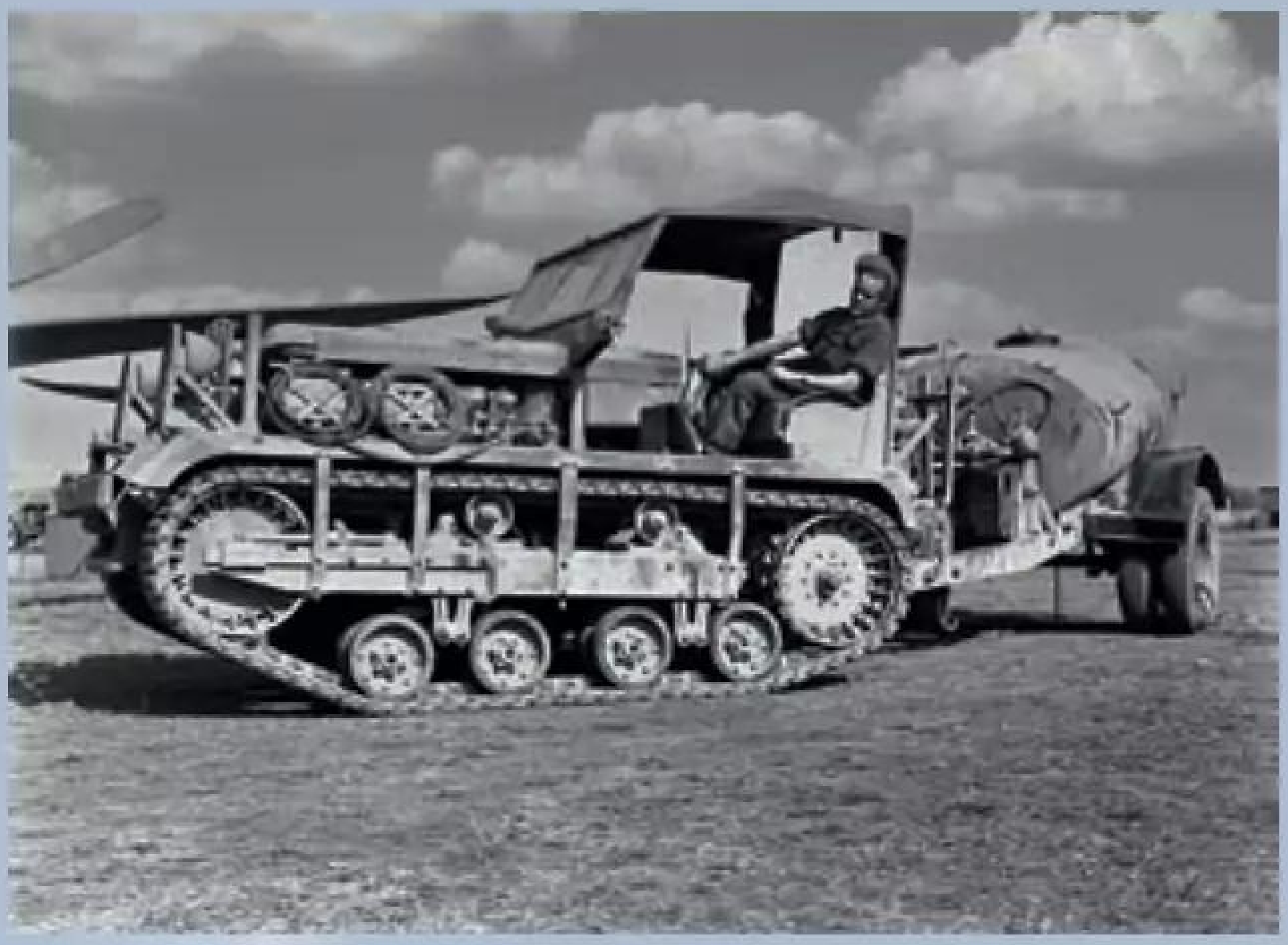
As the Second World War took hold, fighters came under a new dictate to land, refuel and re-arm immediately, especially during the Battle of Britain to be combat-ready for the next sortie. Pilots expected to be



A Short Stirling of N° 1651 HCU (Heavy Conversion Unit) is being refuelled by an AEC 'Matador' 6 x 6 refueller (left) while a trailer bowser replenishes the oil at Waterbeach in 1942. *Image: IWM HU 107753 Public Domain colour creation by Howdi Colour Works*

Fortunately, a few AEC 'Matador' type 6 x 6 refuellers have survived, some in private hands, but this one is at the Yorkshire Air Museum at Elvington. *Image: © 2025 Millhouse Archive – Mike & Julie Blenkinsop*

RAF personnel inspect six Australian-built Bristol Beaufort Mark Vs, shortly after their arrival at Kallang, Singapore. The aircraft were intended for the re-equipment of N°100 Squadron RAF, but there were operational difficulties, so only one was used for photographic reconnaissance work. Hopefully no-one was smoking, as the ensemble are holding up the fuelling lines from a Ford refueller on Christmas Day 1941. *Image: IWM/Australian War Memorial Public Domain*



Cletrac High-speed seven-ton M2 tractor powered by a Hercules 6-cylinder 137bhp engine used by the RAF and the Americans for towing petrol bowsers and aircraft. This one is being used by 40th Photo Reconnaissance squadron on Akyab Island, 1945. *Image: Frank Bond – Bond Photograph Library Public Domain*

Ground crew, including a WAAF, refuel a Hawker Hurricane Mk IID of N° 1 Specialised Low Attack Instructors School at Millfield, Northumberland, prior to a training sortie, 21 January 1943. *Image: P/O Stannus, RAF official photographer, IWM CH 18134 Public Domain*

'scrambled' five or six times a day at the peak of the action in August 1940, so refuelling teams would have been working flat-out.

The same would apply to the bomber squadrons; there were 24 RAF stations catering for this fleet. When a big op was planned, there could be 1,000 bombers in the raid. Usually four-engine Avro Lancasters or Short Stirlings needing to be fuelled with 2 million gallons of fuel, 70,000 gallons of oil and 5,000 gallons of coolant; not forgetting the crew requirement of 8,000 pints of strong coffee!

However, at this time, the problem lay in the speed of delivery from the tanker to the aircraft as 30-50 gallons would be the norm, being pumped into the aircraft per minute. With a Lancaster requiring 2,154 gallons and with one bomber station having a fleet of 40 bombers, it was calculated that five 2,500-gallon tankers were needed to service the bombers for a refill over

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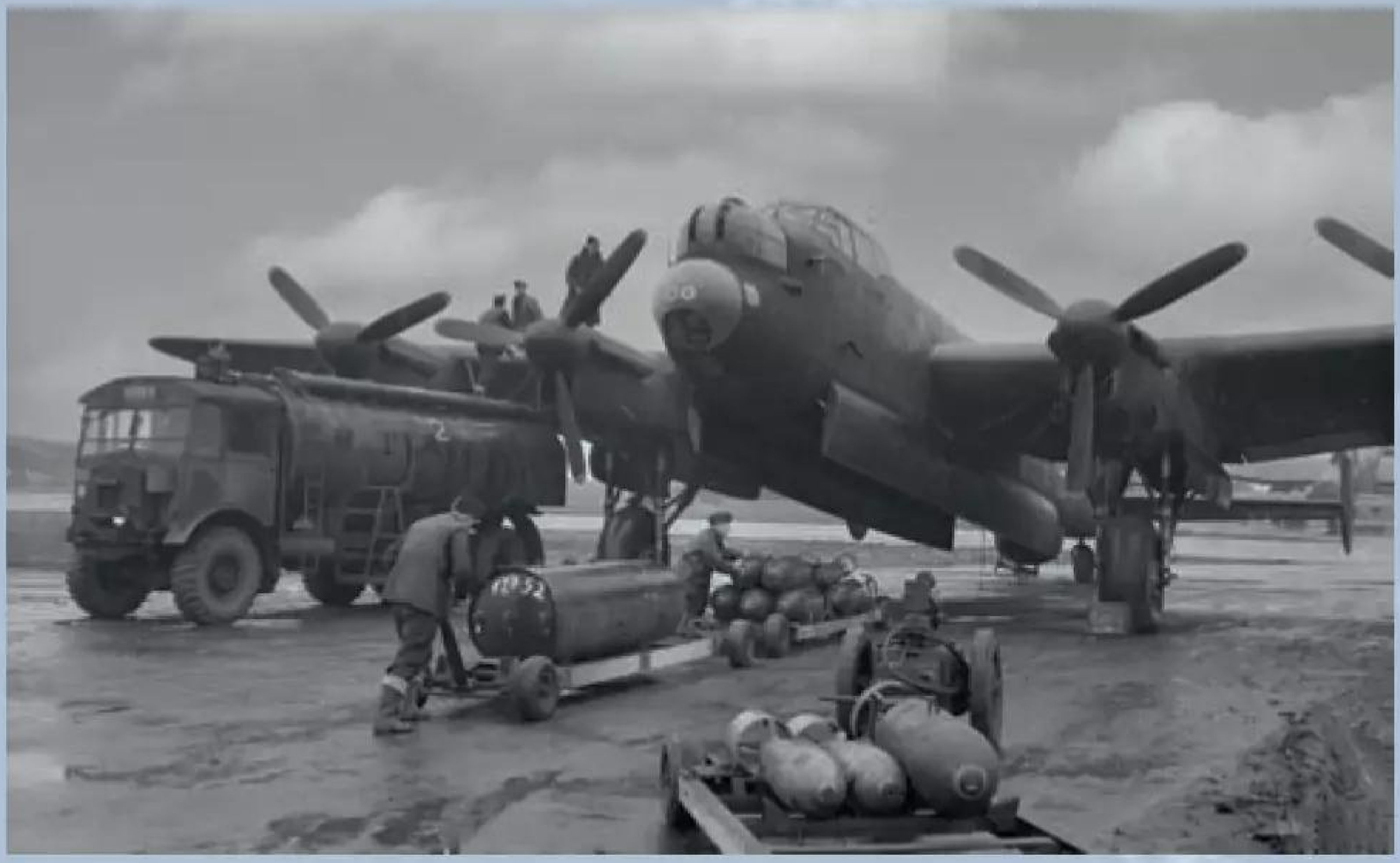
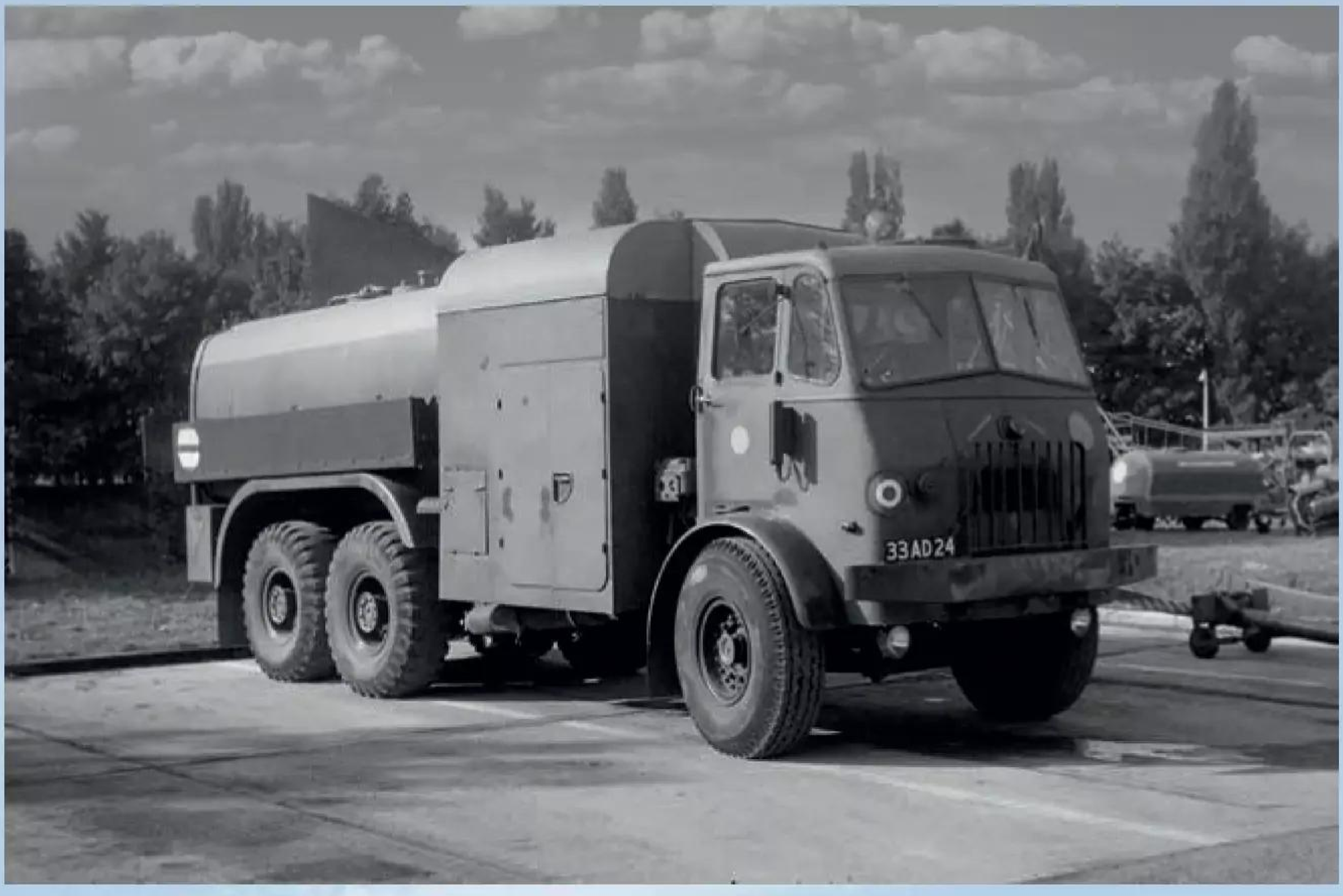


Ground crew refuel from an AEC 'Matador' 2,500-gallon tanker while a second crew loads up bombs into an Avro Lancaster of N° 75 (New Zealand) Squadron RAF at Mepal, Cambridgeshire for a night raid on Krefeld, Germany. *Image: IWM CH14680 Public Domain*

Two technicians refuelling an RAF bomber from a 2,500-gallon 'Matador' tanker. *Image: IWM Public Domain*

Ground crew refuelling a Gloster Meteor F Mk III of N° 616 Squadron RAF at Manston, Kent, 4 January 1945. *Image: F/Lt Miller RAF official photographer IWM CL 2922 Public Domain*



After the war the Leyland Hippo 19H/1E Mk IV 2,500-gallon Thompson became the main tanker. Later classified at FV11202 in the later military nomenclature system. *Image: © The Transport Library PM Photography*

eight hours to 'brim' their tanks. Hundreds of new ground-based tanker type vehicles were needed urgently! It is mentioned in war notes that Douglas Bader was asked by Sir Winston Churchill in 1940 what the RAF needed most, his answer: "More bl**dy bowsers!"

Along with AEC, the RAF developed the well-proven British Army Matador 4 x 4 Medium Artillery Tractor into a 6-wheel drive aircraft refueller by adding a double bogie to its chassis. These were used on both fighter and bomber stations to refuel aircraft from a 2,500-gallon tanker body, the pumping equipment being in a separate compartment at the back of the vehicle. They weren't really Matadors, just that they looked like Matadors with an extra axle, no-one bothered to give them a name (they were busy fighting a major war after all), but they 'sort of' acquired the name 'Marshall' as they used the double-drive rear bogies from the commercial 'Marshall' to provide a 6 x 6 configuration, giving sufficient drive to access aircraft parked-up on all kinds of airfield ground conditions. They were known under the AEC designation O854, the O being the term for an Oil/Diesel engine. There were 514 examples built, and they were quite a beautiful design. Some have fortunately survived. The Yorkshire Air Museum has one, while Martin Howdle has just purchased RAF AO 14562, a 1943 tanker marked up as belonging to N° 5 Bomber Group. Martin reckons that there are only eight survivors left in the country and their success as refuellers was due to matching their fuel capacity to the tanks of the Avro Lancasters which they were refuelling every night, a batch of them would be replenishing a squadron

Following on from the Hippo, the Ergonomic-cabbed AEC Mammoth Major replaced the aging fleet, seen here with its fuel bowser trailer. *Image: © The Transport Library PM Photography*

The last tanker for this era was the AEC mammoth Major six-wheel twin- boom refueller. *Image: © 2025 Millhouse Archive – Mike & Julie Blenkinsop*

of 60 bombers all day, for their next night bombing mission. When you realise that a bomber squadron of Lancasters could have 60 planes taking off in one night from airfields, it gives some idea of the amount of aviation fuel required to keep them in the air and this was often needed night after night.

Meanwhile on virtually every fighter squadron in the UK and abroad, the ubiquitous Bedford QL fuel bowser would be the airfield tanker. Early examples were designed as a basic 850-gallon tank with standard hoses delivering fuel to the fighters. To expand on that statement, in fact, they had two hinged doors at the rear, containing 6 x 123in long, 1.5in-wide hoses and 2 x 143in long, 2in-wide suction hoses, and a Bradford three horsepower petrol engine to drive the pump. Later models came with attached swinging booms holding the hoses to make overwing delivery that much easier.

Butterfields built a new 1,000-gallon tank for the QL, but these were reduced to 950 gallons after initial deliveries; a pto powering the pump from the vehicle's gearbox made delivery more effective. The all-wheel drive QL was one of the 'hero trucks' of the war. Bedford turned out 52,245 of them in five years with every conceivable body being attached to the chassis. The fuel bowser was a particularly good example, with four-wheel drive giving the refuelling teams access to their aircraft under all ground conditions. The drive came from the company's own well-proven 6-cylinder 3,519cc petrol engine which was fitted to the whole range of Bedford Army trucks, including the 15cwt MW and the OY 3-ton chassis giving 72bhp at 3,000rpm and a top speed of 48mph. In later years the Bedford QL refuellers would also double-up as snowploughs to keep runways clear.

The mainstay of the Battle of Britain was the iconic Supermarine Spitfire and the more numerous, but, sadly, less heralded Hawker Hurricane. The Spitfire had its tanks located under the pilot and in the wing structure, as did the Hurricane, so you would see the refueller team sitting on either the wing or placing their fuel nozzles into the tank in the fuselage ahead of the pilot. There was one distinct advantage that 'our boys' had over the Luftwaffe pilots, for which we need to thank Eugène Houdry from Dormont, Paris, a French American inventor who played around with the chemistry of the aviation fuel being supplied to the RAF. Using catalytic conversion cracking, he managed to raise the octane rating to 100 by this process at a time when the Messerschmitt's of the German Air Force were still using 87 octane fuel. By achieving this improvement, it increased the speed of the Spitfire and Hurricane by an average of 30mph, improved boost pressure, climb rate and overall power over their Messerschmitt Bf 109 rivals. It was known as B.A.M. 100 and it gave the RAF the edge on performance.

In the early days, pictures of aircrew running around the airfield with two- gallon metal cans of fuel weren't unusual, but technology had moved on to improve the product and speed of delivery, although safety procedures were still paramount. The risk of explosion and fire were evident, so the vehicles and the aircraft had to be carefully bonded and earthed to prevent a static electric spark igniting the fuel. The aircraft themselves were earthed through their metal-impregnated tail wheels, while the refuelling tankers dragged a metal chain behind them, grounding them as they traversed the airfield. As a secondary precaution, a metal spike was hammered into the ground, contacting with the vehicle whilse refuelling was going on.

One other safety consideration would be paramount in the minds of the fuelling technicians in that the metal nozzles on the swinging booms could easily damage the sensitive skin of the aircraft, so great care had to be taken in metal nozzle to metal cap being positioned accurately.

Peace having been achieved, a new generation of refuellers appeared, based on a rebuilt design of the wartime 6 x 4 Leyland Hippo chassis, the 19H pressure refueller with its 2,500-gallon Thompson-built tanker body, which worked through until the 1970s. Following those were the Ergonomic-cabbed AEC Mammoth Majors, but they take us way past the classic aircraft period. ■

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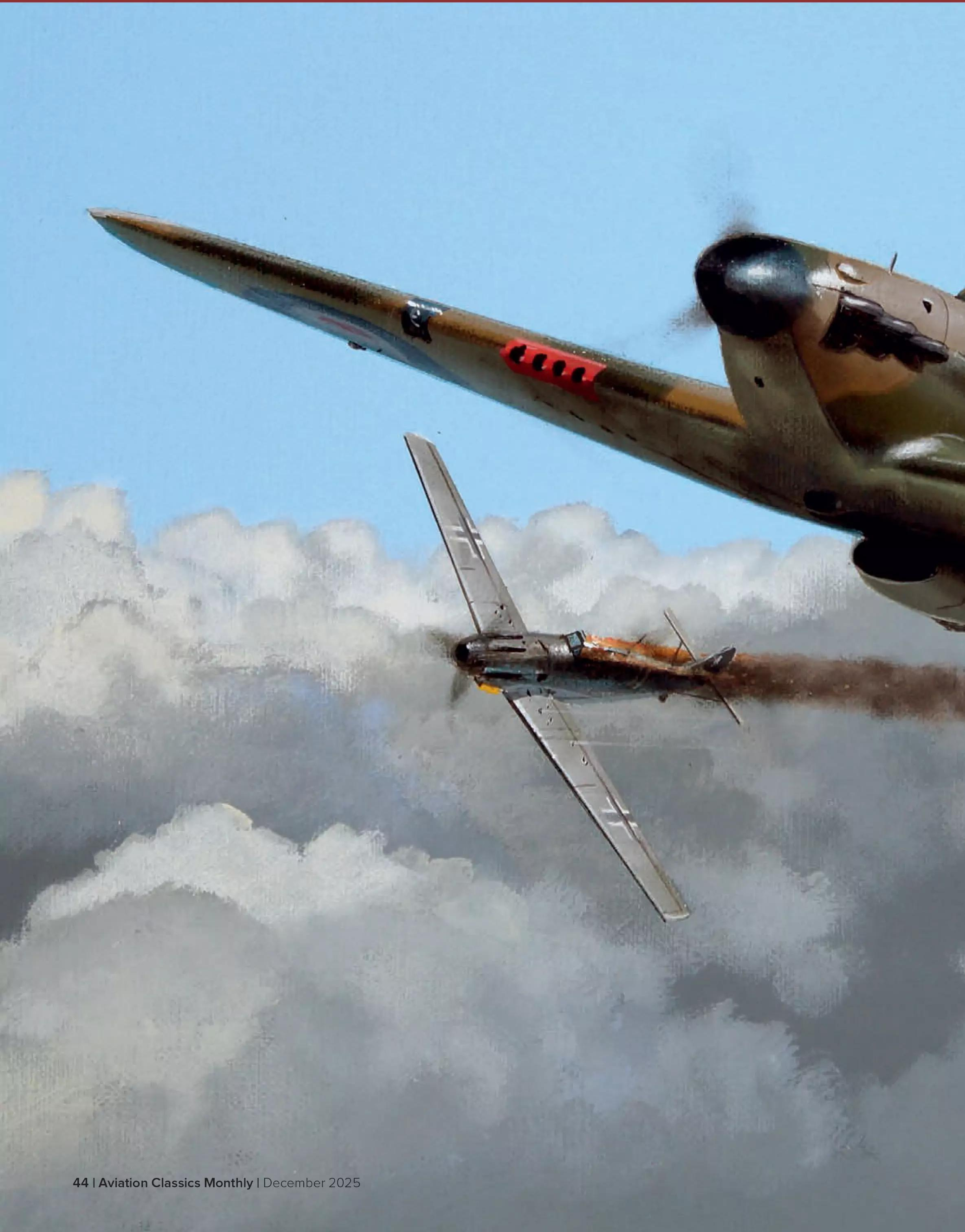

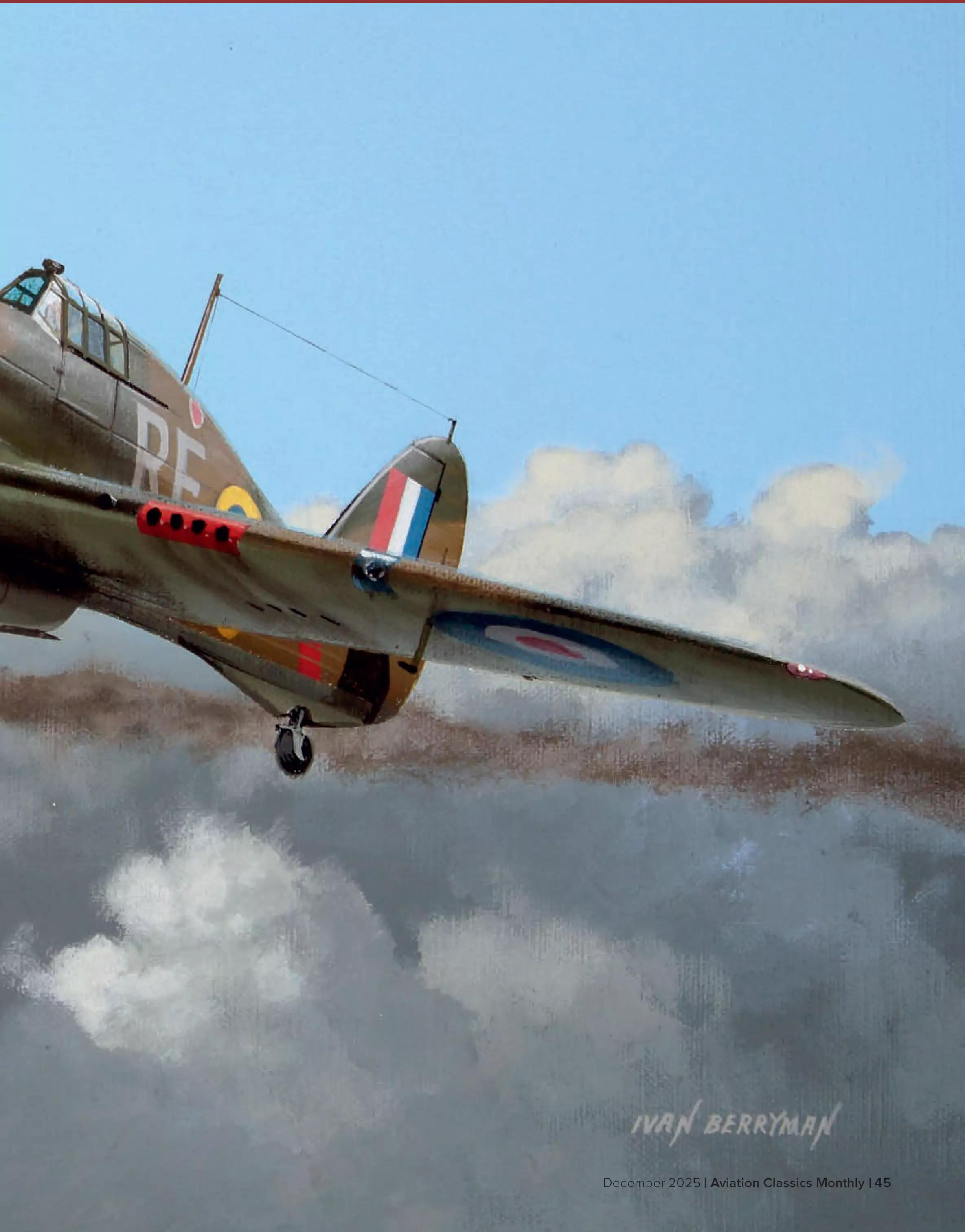
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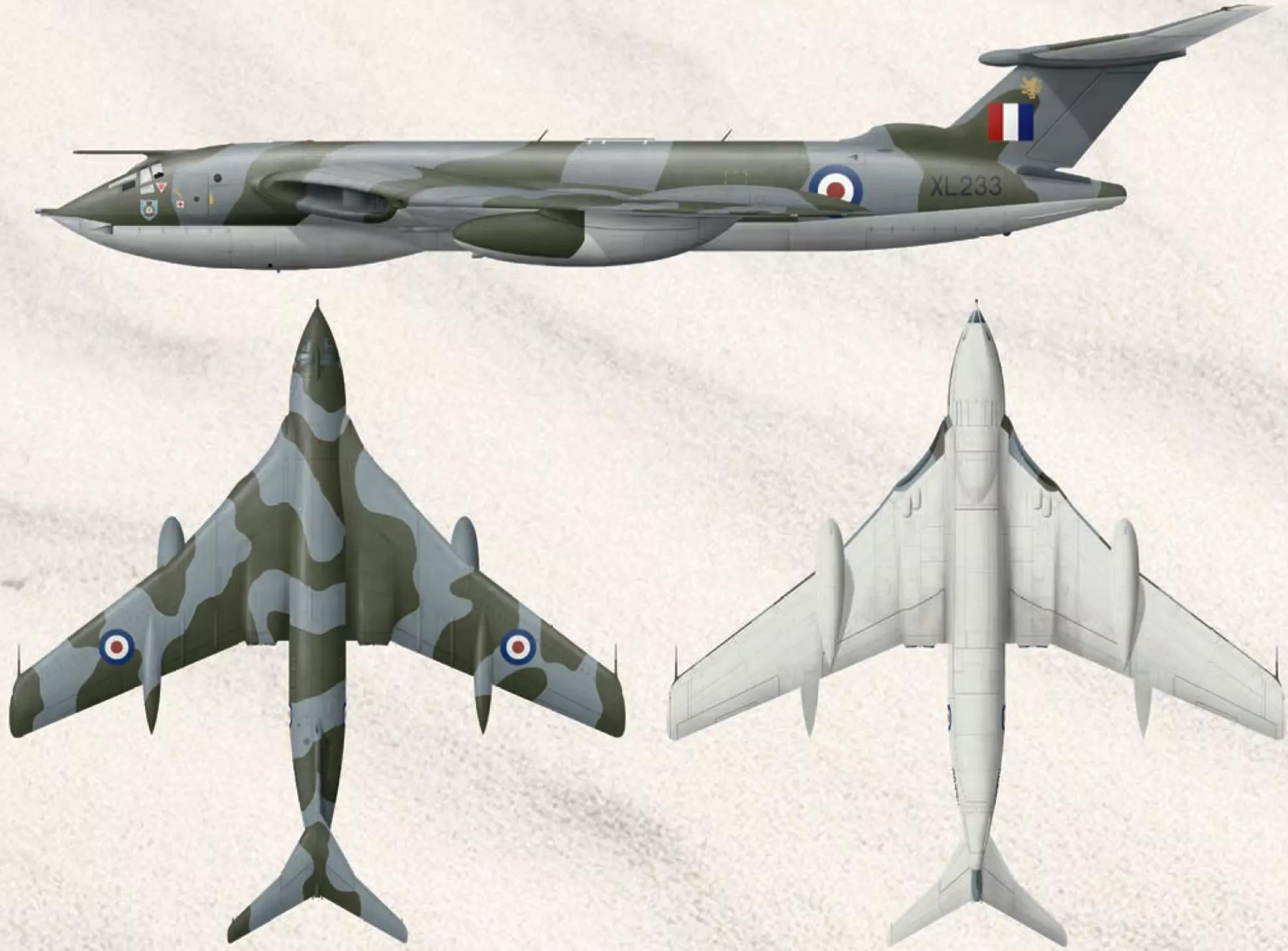
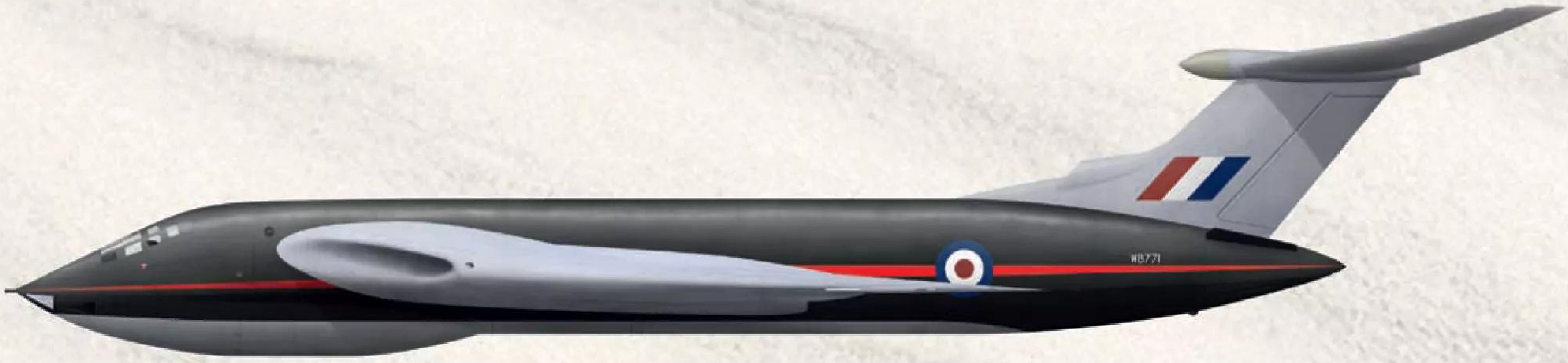


VICTOR B.2 XL233 WITTERING WING
This aircraft was operated by Wittering Wing until it was converted to a tanker in 1970, going on to serve with 232 OCU and 55 Squadron. It was painted in standard RAF camouflage of dark green and medium sea grey upper surfaces and white undersides. The Wittering Wing shield was on the nose.

Handley Page Victor

Although the Avro Vulcan entered service four months earlier, the Victor served nearly a decade longer as a tanker, making significant contributions during two conflicts. Like the Vulcan, the Victor was advanced for its time in both design and performance, with its low crescent wings and smooth intakes giving it a futuristic appearance even in the 21st century.



VICTOR PROTOTYPE WB771

The first prototype Victor originally wore an all over aluminium finish. It was repainted for the 1953 SBAC Show in matt black with red trim on the fuselage and with the wings and tail remaining in aluminium.

Of Specification B.35/46 sent out by the British Air Ministry for the production of a high-speed jet bomber capable of carrying nuclear bombs, the three main aircraft developed were the Avro Vulcan, Vickers Valiant and Handley Page's proposal was the HP.80. The specification had been anticipated by Sir Frederick Handley Page in 1945 when he became aware of the contract issued to English Electric for a jet-propelled bomber (the Canberra). He instructed the design team at Handley Page to start investigating both a twin-engined bomber and a larger four-engined type. Research by company aerodynamicist Dr Gustav Lachmann suggested that a swept crescent style wing would be suitable for the near Mach speeds the HP.80 would reach.

Much of the research that led to the HP.80 came from the HP.75 Manx experimental tailless aircraft which had been built by subcontractor Dart Aircraft. It was commissioned in 1937 and delivered in 1939 but did not fly until June 11, 1943, due to issues with structure, weight and the rapid deterioration of the wing structures. However, when it did eventually fly the research gathered convinced the Handley Page design team that scaling up the concept would be feasible and it was fed into the HP.80 programme.

Another research aircraft, the HP.88 was then built under contract by Blackburn to generate more data. Consisting of a Supermarine Attacker fuselage with new wings similar to those intended for the HP.80, it was unfortunately destroyed only 36 days after its first flight.

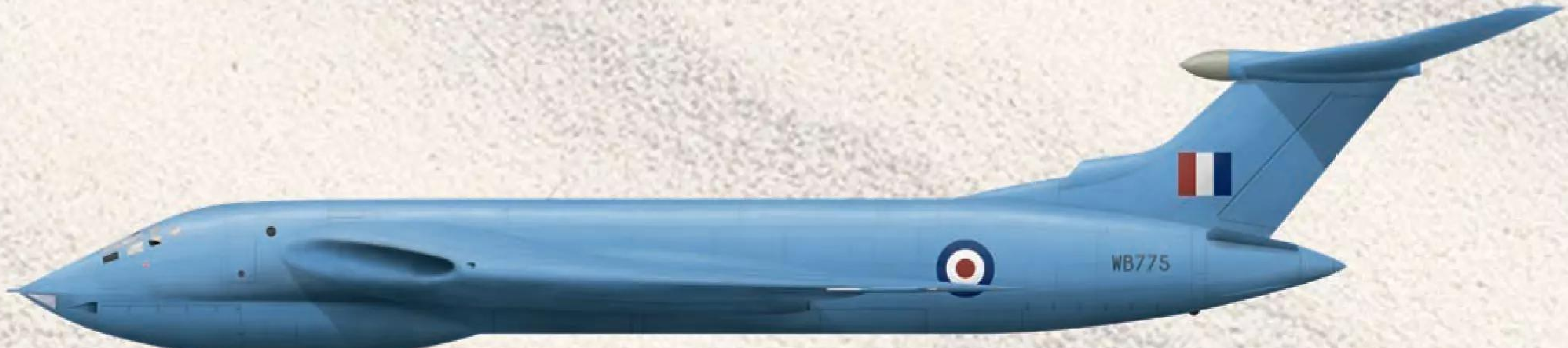
The form of the HP.80's wings may have been advanced but many other aspects of the design were conventional; the fuel tanks were fitted into the wings and the weapons bay, with space for a 10,000lb atomic bomb, was in the centre of the fuselage.

A pressurised compartment in the nose accommodated the crew of five — pilot, co-pilot, navigator/plotter, navigator/radar operator and radio/electronic countermeasures operator. Only the two pilots had the luxury of an ejection seat, the three other crew having to bail out via the door in the event of an emergency. The door was at least fitted with a cover to protect them as they entered the slipstream.

Work on the first HP.80, WB771, was progressing at a steady pace by May 1952 and thoughts turned to its debut flight. The facilities at Radlett airfield, Hertfordshire, were deemed unsatisfactory by the Ministry of Supply and it was therefore ordered that the aircraft should be moved to Boscombe Down, where the 10,000ft runway would allow ample space for the untested bomber.

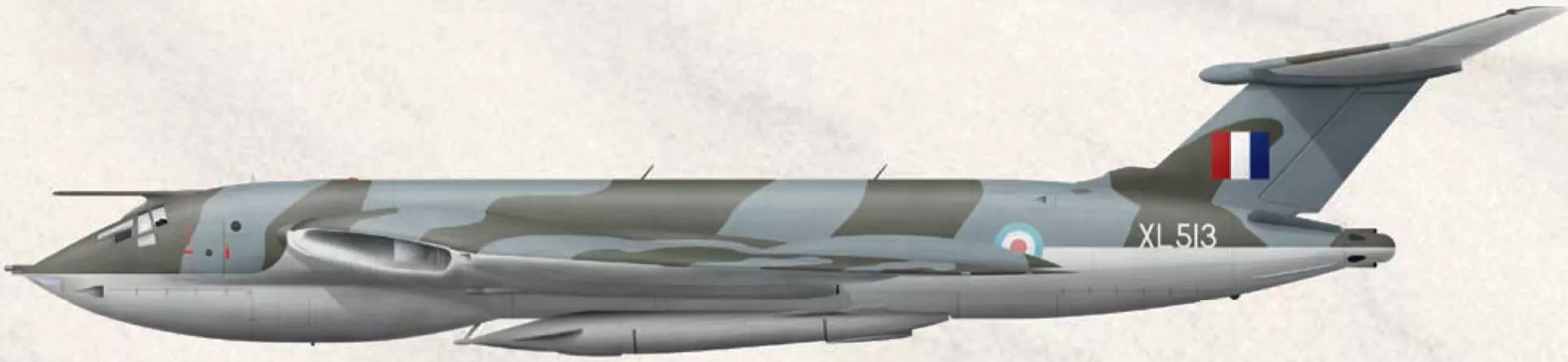
Moving such a large aircraft along the ground — even in sections — meant the roads along the route had to be specially modified. Once everything was settled at Boscombe Down, work commenced on putting WB771 back together and completing it. There was added pressure because Handley Page was still competing with Avro at this stage and was uncertain whether the Victor would win the contest for orders.

Delays to the project meant that the aircraft did not even get to taxi until the week before Christmas but on Christmas ➤

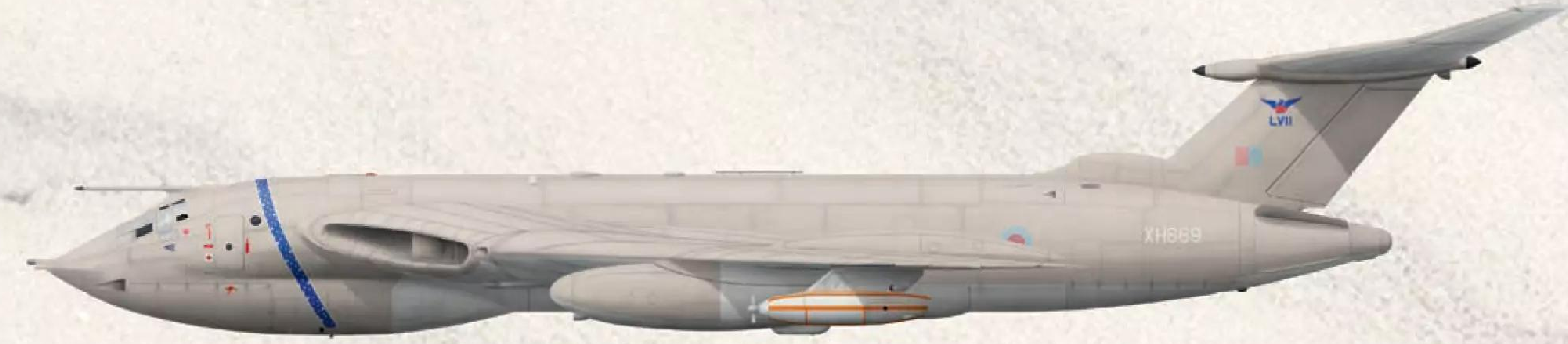


VICTOR PROTOTYPE WB775

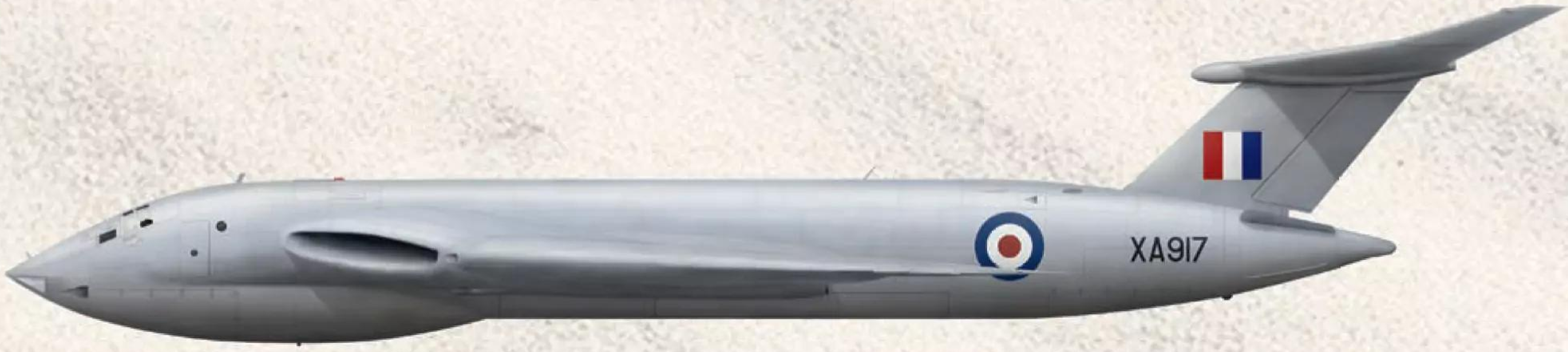
The second prototype was painted in cerulean blue for the SBAC Show in 1955. Following trials, the aircraft was transferred to Proof & Experimental Establishment at Foulness in 1961.



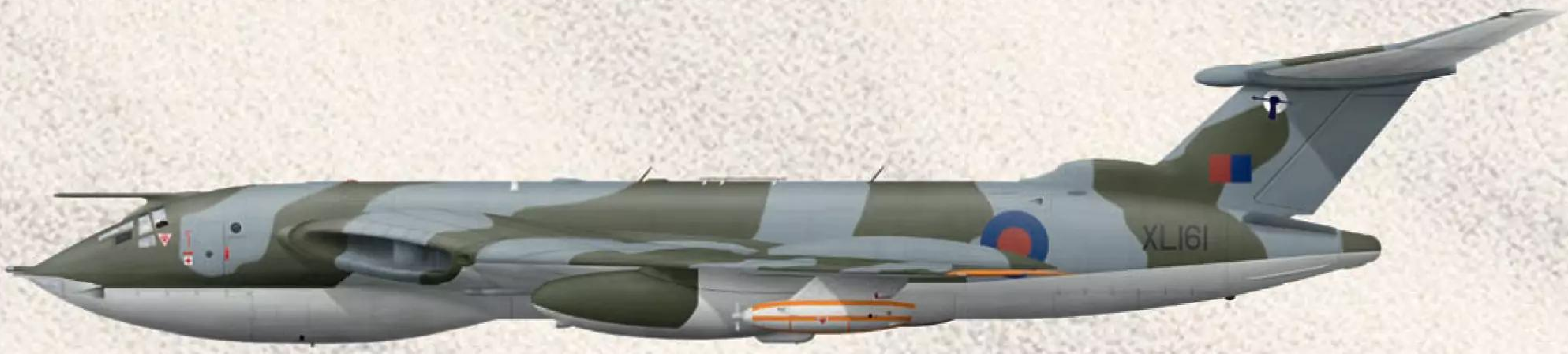
VICTOR B.2R XL513 139 SQUADRON
XL513 was used for camouflage trials, being the first Victor to wear such a scheme. Unlike all other camouflaged Victors, this aircraft was painted in NATO green (ref No. 409) and NATO grey (ref No. 407). It also retained the anti-flash roundel on the fuselage. The aircraft crashed on take-off at RAF Marham in 1976 due to a bird strike.



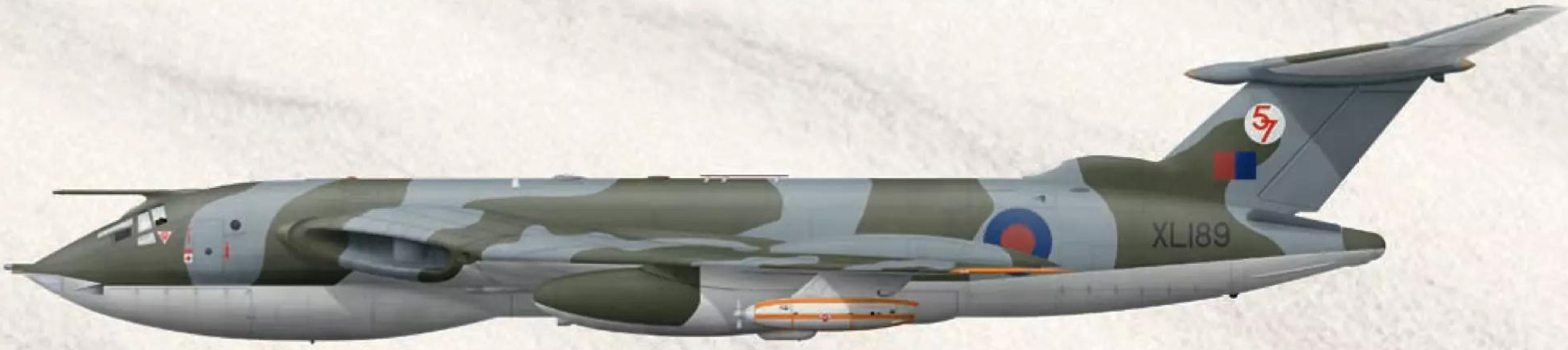
VICTOR K.2 XH669
XH669, piloted by Flt Lt Steve Biglands, was originally intended to fly the longest section in support of the Vulcan during the first Black Buck mission. However, the aircraft's probe broke during refuelling and XL189 flown by Sqn Ldr Bob Tuxford had to fly the final leg.



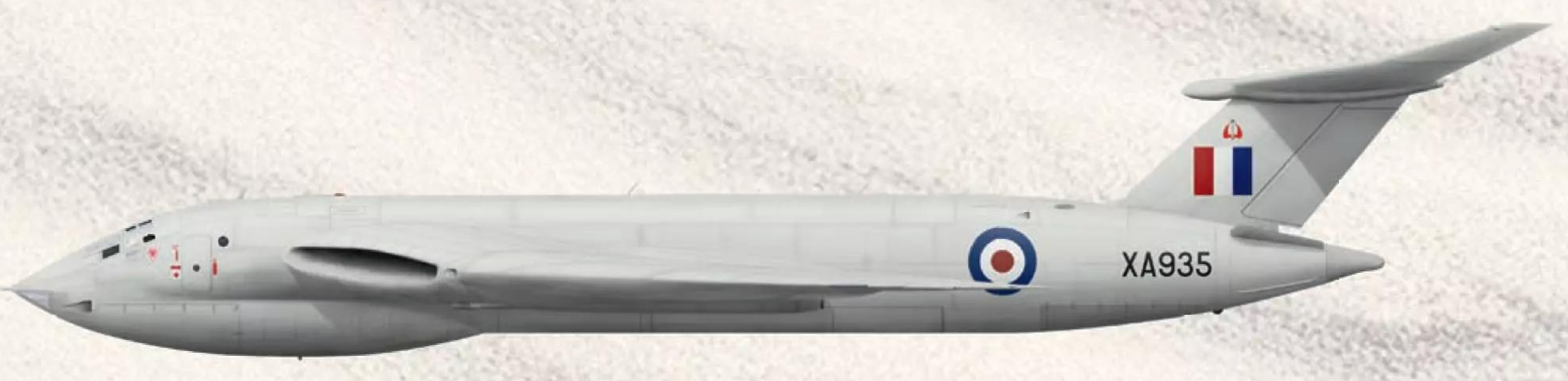
VICTOR B.1 XA917 A&AEE
All the early Victors including XA917, the first production aircraft, were painted initially in all over aluminium with standard RAF markings and serial.



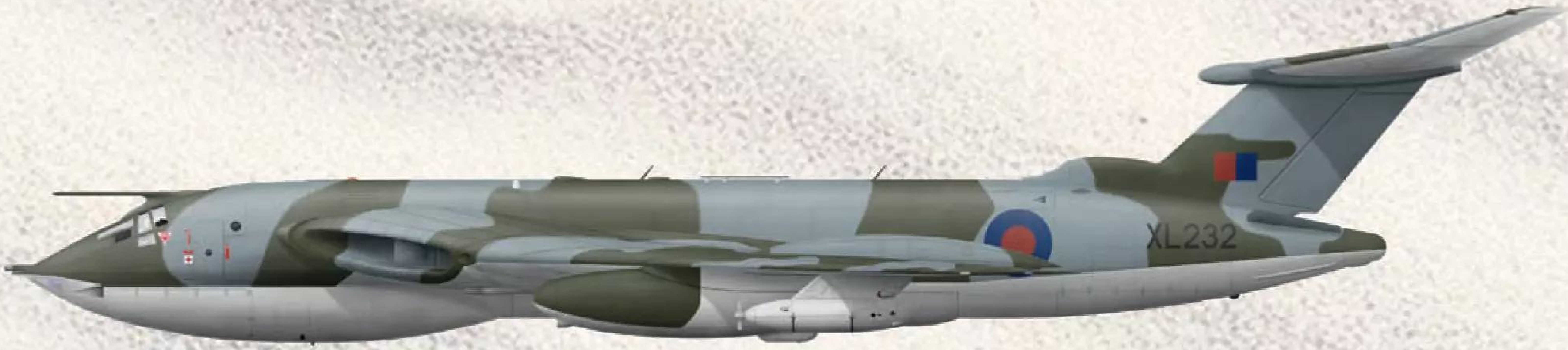
VICTOR K.2 XL161 55 SQUADRON
Seen here in typical K.2 tanker configuration with tanks and high visibility markings on the refuelling pods and wings, XL161 was transferred to RAF Lyneham and was used as a ground trainer from 1993 to 1995.



VICTOR K.2 XL189 57 SQUADRON
Having been upgraded to B.2R standard, XL189 was then converted to a tanker in 1970 and served with 232 OCU, 55 & 57 squadrons. In 1986 it became a ground trainer at RAF Waddington.



VICTOR B.1 XA935 10 SQUADRON
Painted in Anti Flash White but retaining the high visibility markings, XA935 is typical of the original B.1 scheme worn by the Victors. The aircraft also served with 15 Sqn and 232 OCU. It was put in storage in June 1964 and officially struck off charge in 1974.



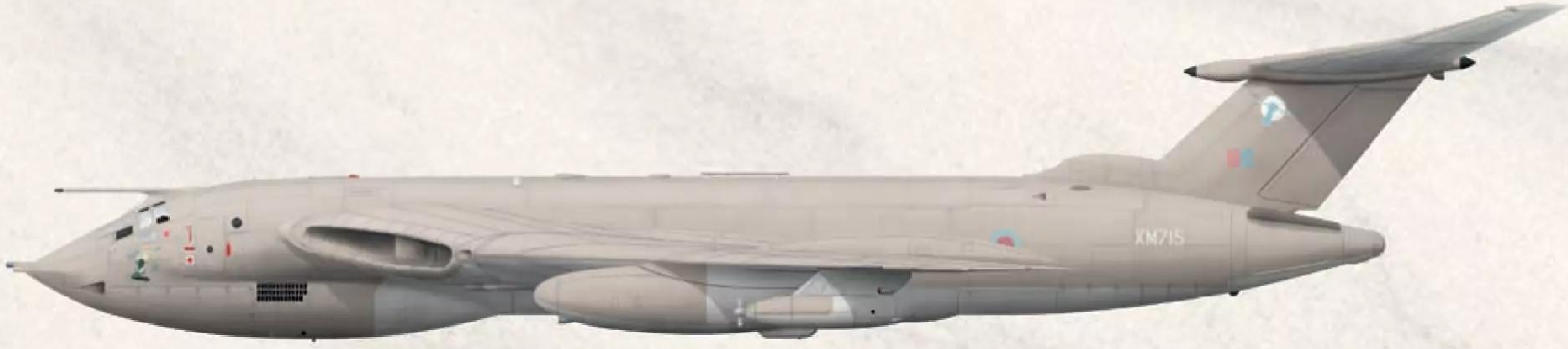
VICTOR K.2 XL232
XL232 had a varied career, serving first as a B.2, then being converted to B.2R and eventually to a K.2. Having served with most of Victor units it was eventually lost during a ground fire following an engine explosion at RAF Marham in 1982.

Eve Handley Page's chief test pilot, Squadron Leader Hedley George Hazelden, was finally able to fly it. With Ian Bennett as the flight test observer, Hazelden took WB771 on a couple of circuits, landing on the second one for what was an uneventful yet successful first flight. As the New Year arrived it was officially announced that the HP.80 would henceforth be known as the Victor in keeping with the preference for the new bombers to be named with a V.

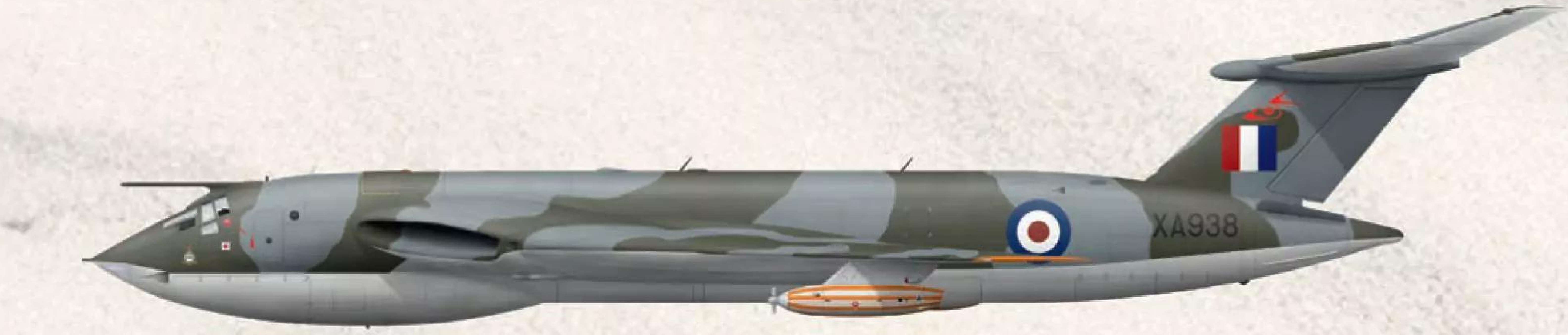
Early trials showed some issues with the undercarriage system. The system stopping the wheels from spinning once they were retracted remained locked on one occasion — causing all 16 of the main wheel tyres to burst upon touchdown. Subsequent flights raised yet more issues but fitting cameras into the undercarriage bays enabled the engineers to quickly identify the problems and deal with them.

When it first flew, WB771 was finished in an overall aluminium and light grey finish but by the time of the SBAC show at Farnborough in 1953 it was wearing a very distinctive scheme of a black fuselage with a red cheat line running the length of the fuselage. The wings and tail retained the aluminium scheme.

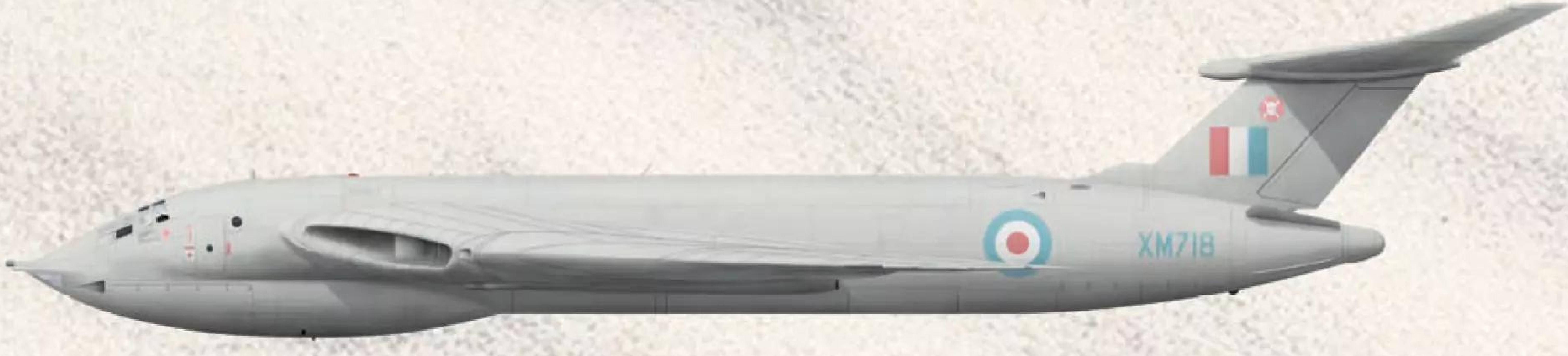
Testing continued at a steady pace until the aircraft reached Mach 0.98 during one high-speed test, causing damage to the skin of the tail. To keep up the testing ➤



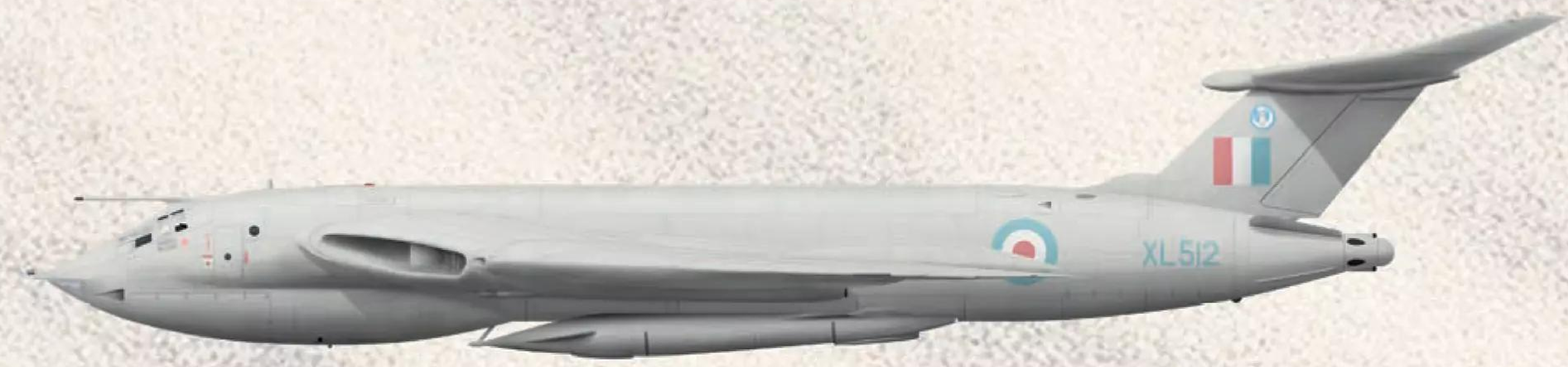
VICTOR K.2 XM715 55 SQUADRON
Converted to K.2 configuration in 1970, XM715 served with 55 Sqn from 1975 to 1993 where it saw action during both the Falklands War and Operation Granby. During the latter it was painted in hemp but this soon faded and weathered. At this time the nose art was applied. XM715 is now preserved at Bruntingthorpe, Leicestershire.



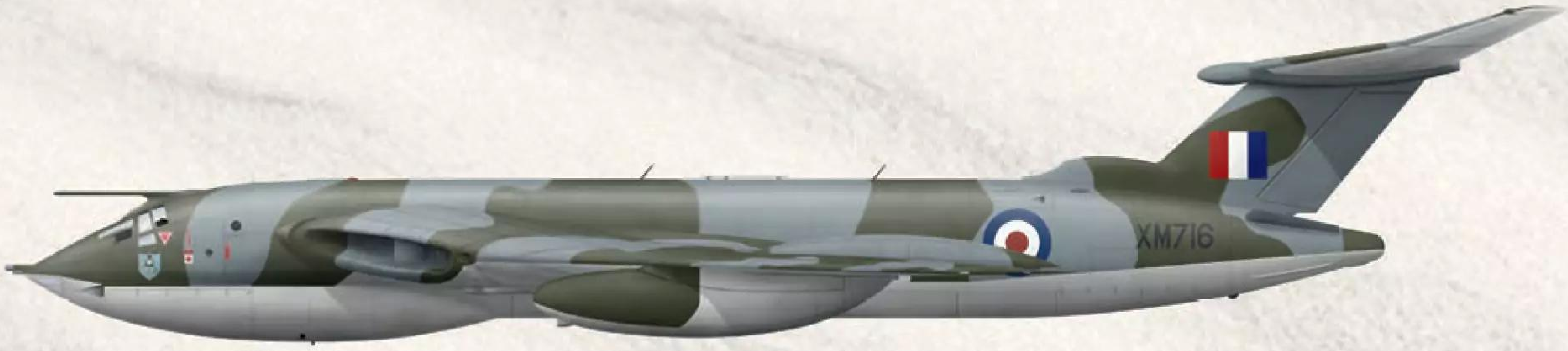
VICTOR K.2P XA938 214 SQUADRON
Despite being converted into a tanker in 1964, there are photos of XA938 without the wing tanks. It was later based at RAE Farnborough and ended up at the Pendine Ranges.



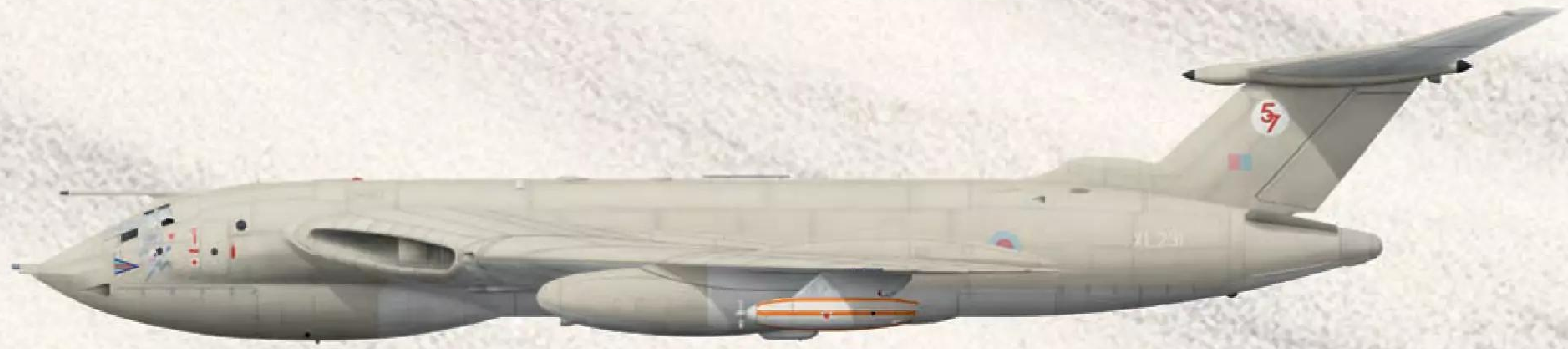
VICTOR B.2 XM718 100 SQUADRON
Delivered to 100 Sqn in May 1963, this B.2 would have worn the typical Victor fleet markings at this time. Three years later it was converted into an SR.2 and struck off charge in early 1976. XM718 was the last Victor built.



VICTOR B.2R XL512 139 SQUADRON
Showing the bomb bay modification that allowed for external carriage of Blue Steel, XL512 was painted in standard anti-flash white with accompanying markings. The aircraft was converted to tanker duties in 1970 and continued to serve until 1994.

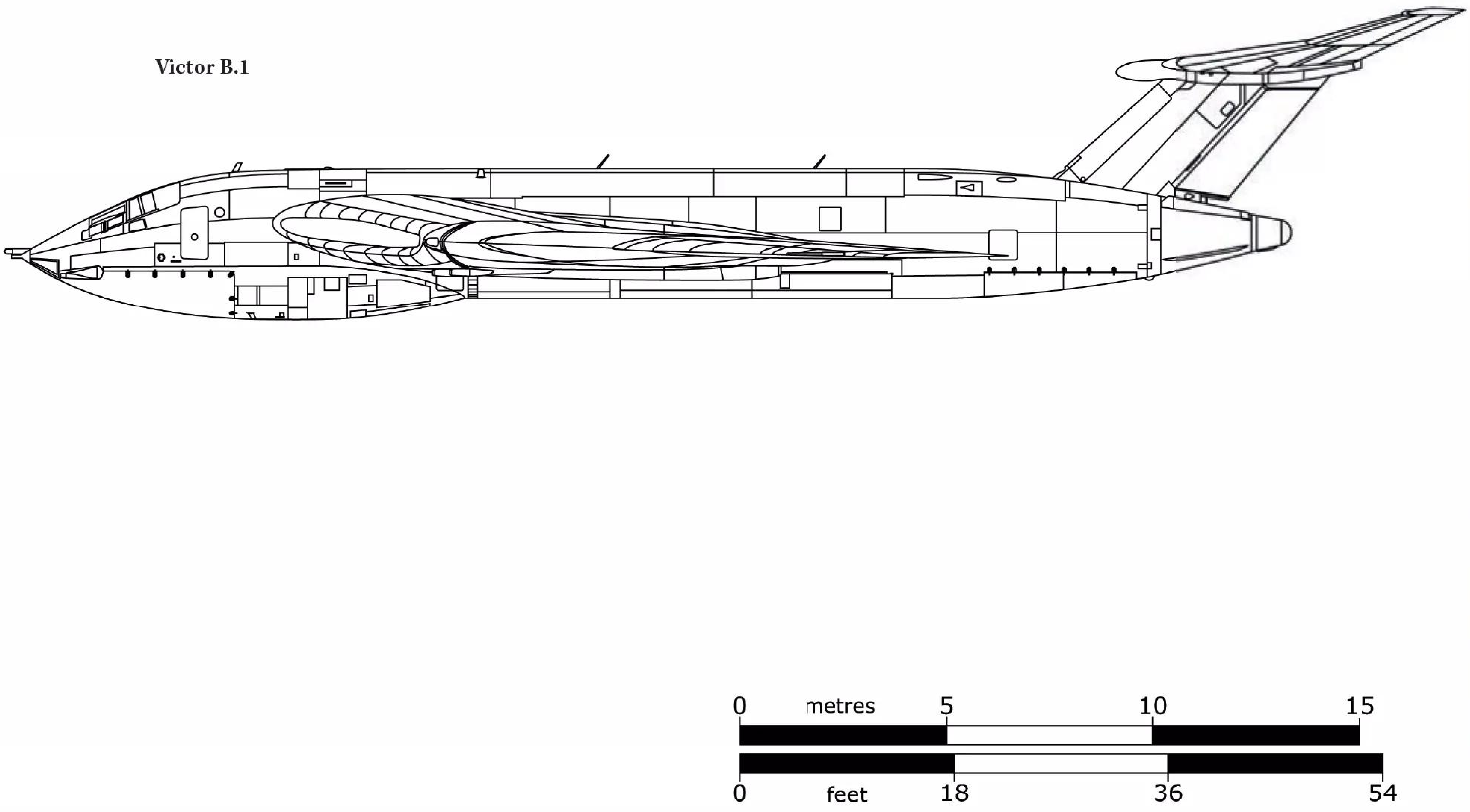


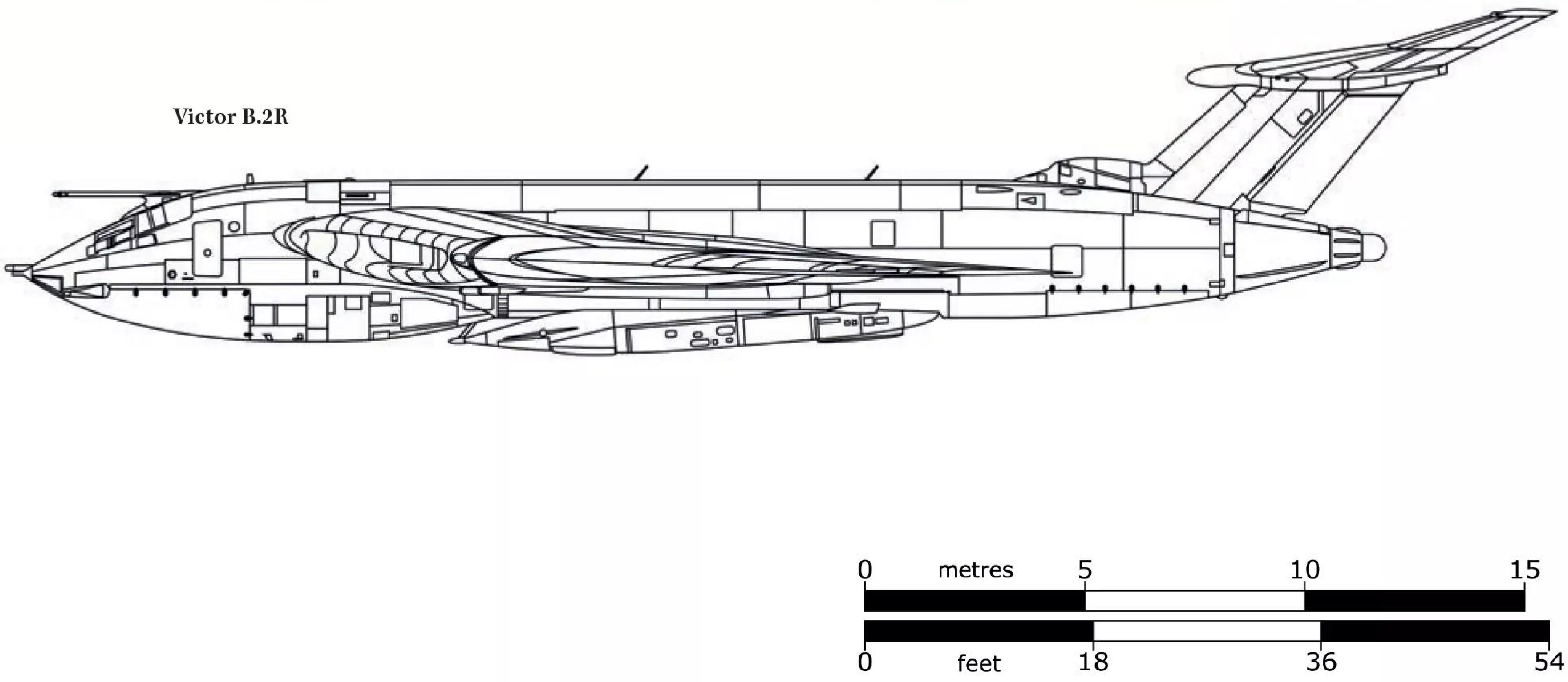
VICTOR SR.2 XM716 139 SQUADRON
Converted into an SR.2 in 1964, XM716 served with 543 Sqn. The tail broke off in mid-air on June 29, 1966, and the aircraft was lost with all crew.

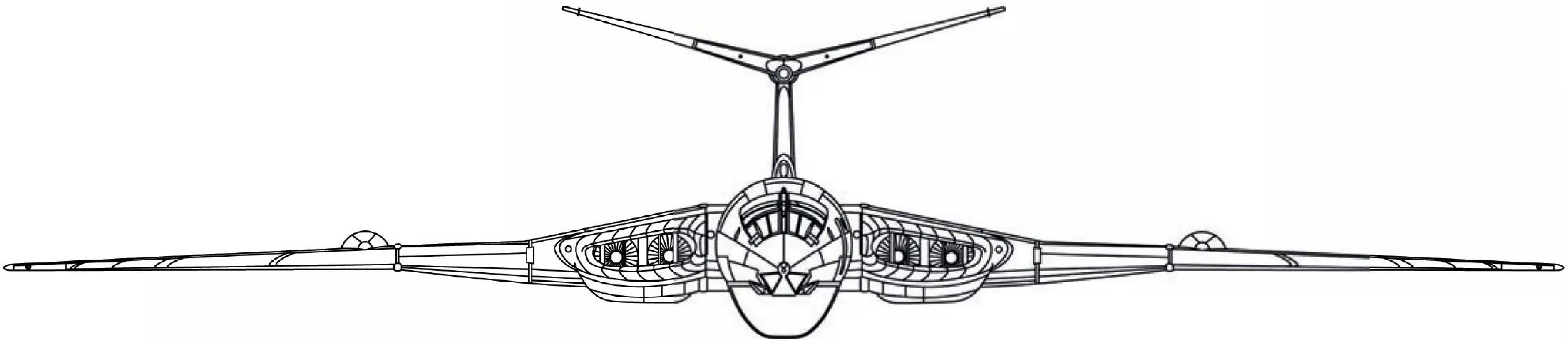


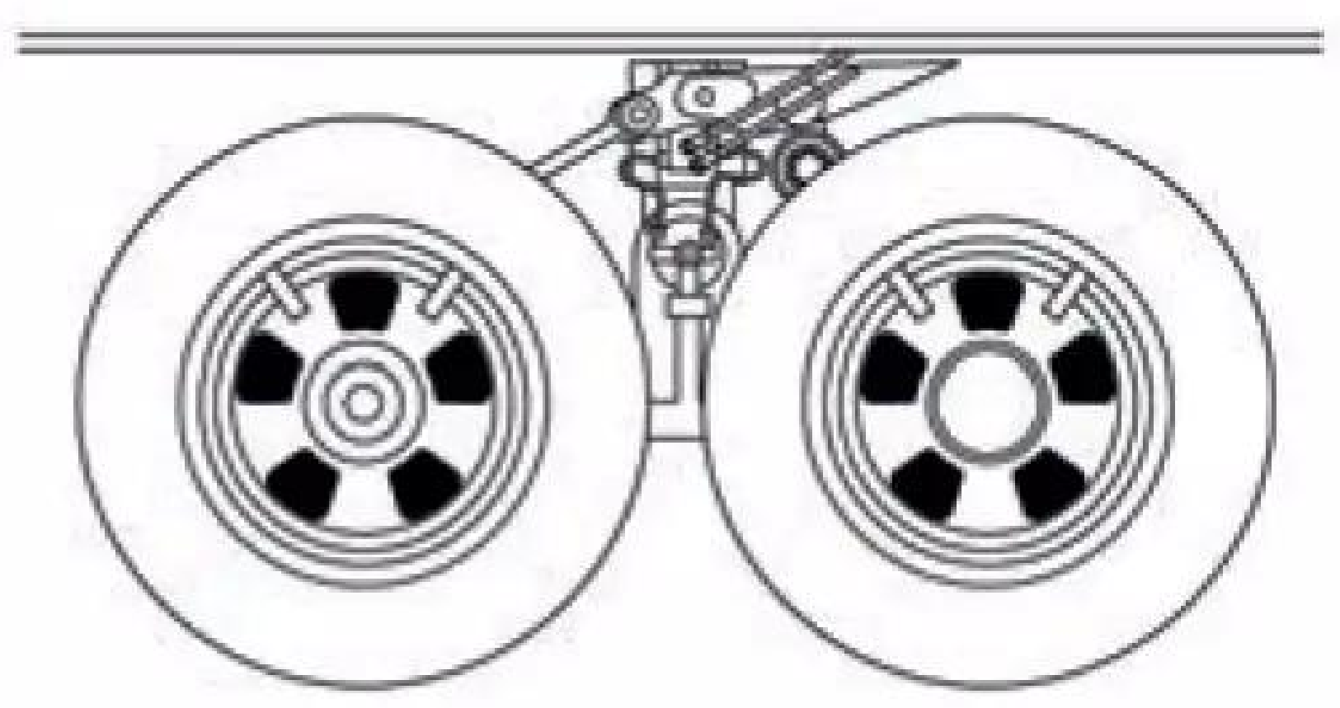
VICTOR K.2 XL231 57 SQUADRON
Entering service as a B.2 with 139 Sqn in 1962, the aircraft saw action with Operation Granby and was eventually acquired by Yorkshire Air Museum where it is currently preserved.

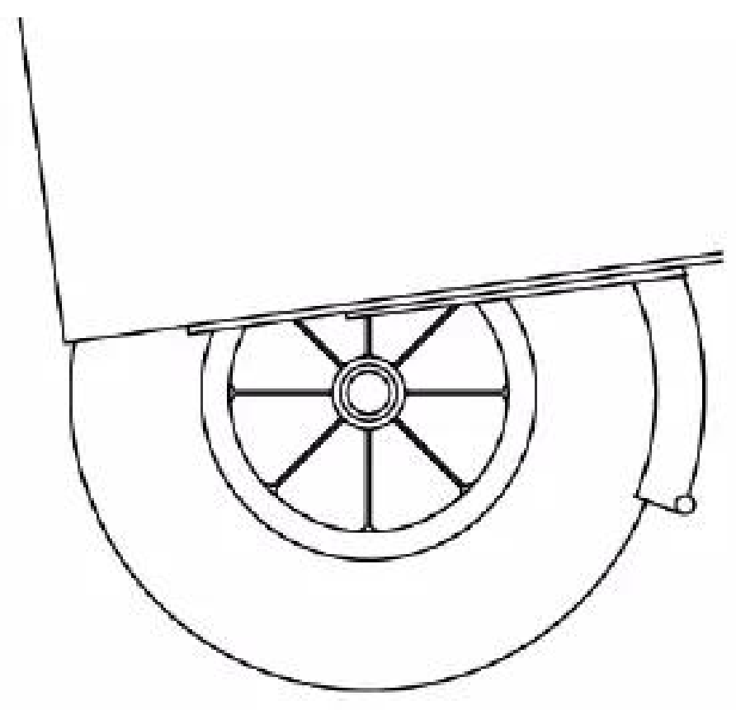
HANDLEY PAGE VICTOR 1/144 SCALE PLANS

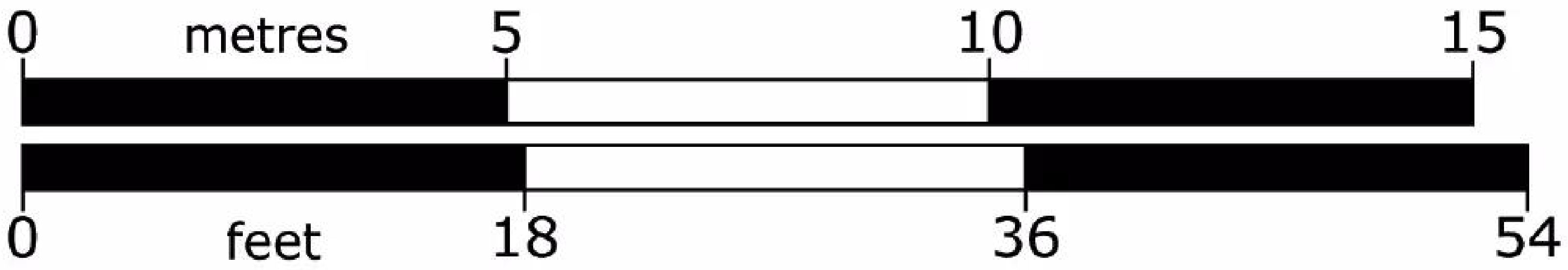



Victor B.2R


Victor B.1 front


Main wheel


Nose wheel

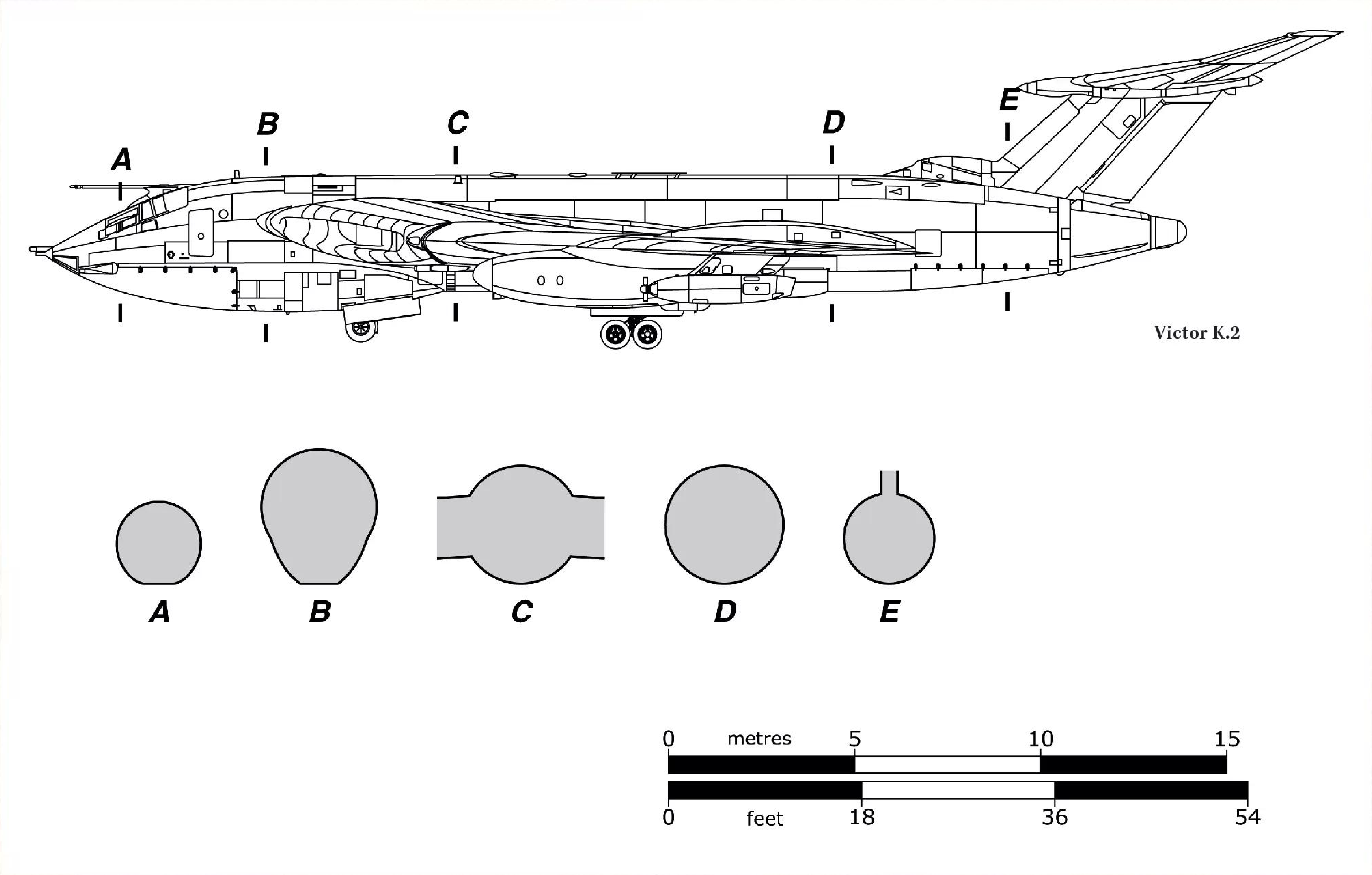


programme, WB771 was given the tail of the second prototype WB775 — which had been nearing completion — and flying continued smoothly until July 14, 1954, when it was called upon to undertake speed calibration tests at Cranfield.

At the controls was Ronald Ecclestone, Hazelden having a prior engagement that day. As he began a second pass of the airfield at speed the tailplane detached from the fin, causing the aircraft to descend at speed into the runway and disintegrate. None of the five crew survived.

Two months later, WB775 was ready to fly and testing resumed. Having completed the trials satisfactorily by the following March, it was delivered to A&AEE for testing by the RAF.

By this time an order had been placed for the B.1, which only had minor differences to the second prototype. The first produc-



Handley Page Victor

VARIANT	LENGTH	SPAN	HEIGHT	ENGINE
HP.80	111FT 7IN/34.01M	110FT/33.53M	26FT 10.5IN	4 X SAPPHIRE 101
B.1	114FT 11IN/35.05M	110FT/33.53M	28FT 1.5IN/8.57M	4 X SAPPHIRE SA.7
B.1A	114FT 11IN/35.05M	110FT/33.53M	28FT 1.5IN/8.57M	4 X SAPPHIRE SA.7
K.1	114FT 11IN/35.05M	110FT/33.53M	28FT 1.5IN/8.57M	4 X SAPPHIRE SA.7
B.2	114FT 11IN/35.05M	120FT/36.58M	28FT 1.5IN/8.57M	4 X CONWAY RCO.11
B.2RS	114FT 11IN/35.05M	120FT/36.58M	28FT 1.5IN/8.57M	4 X CONWAY RCO.11
B(SR).2	114FT 11IN/35.05M	120FT/36.58M	28FT 1.5IN/8.57M	4 X CONWAY RCO.11
K.2	114FT 11IN/35.05M	117FT/35.66M	28FT 1.5IN/8.57M	4 X CONWAY RCO.11

tion Victor, XA917, flew on February 1, 1956. Unlike subsequent B.1s, XA917 was destined for A&AEE where it remained until suffering a crash landing at Radlett in January 1964. Rolls-Royce's Avon engine had originally been proposed for the Victor but by the time the B.1 flew it was fitted with four Armstrong Siddeley Sapphire ASSa seven engines.

232 Operational Conversion Unit received XA931 on November 28, 1957. By now all Victors coming off the production line were finished in all over white but with standard national markings. It was not until later that the markings were toned down.

232 OCU, based at RAF Gaydon, already had several Valiants and these were allocated to B Squadron, making way for the Victors to form A Squadron.

By April 18 the following year, 10 Squadron was re-formed at RAF Cottesmore as the first operational Victor unit. This was slightly marred by the fact that there were only two aircraft on strength. A further six were delivered over the remainder of the year. During September, 10 Squadron was joined by 15 Squadron.

A great deal more had been learnt about the Victor by now and advances in electronic counter measures had been made — so an upgrade programme was initiated for the existing B.1s and those still in production were built as B.1As. The same ECM features were also fitted to the Vulcan fleet at this time. In-flight refuelling equipment was also fitted during the upgrade, though for some reason the probe was not added.

Units receiving fresh Victor deliveries now included 10 Squadron, 15 Squadron, 55 Squadron, 57 Squadron, 100 Squadron, 139 (Jamaica) Squadron, 214 Squadron, 543 Squadron and 232 OCU. The last of the 50 Mark 1s was delivered to the Honington Wing on March 3, 1961.

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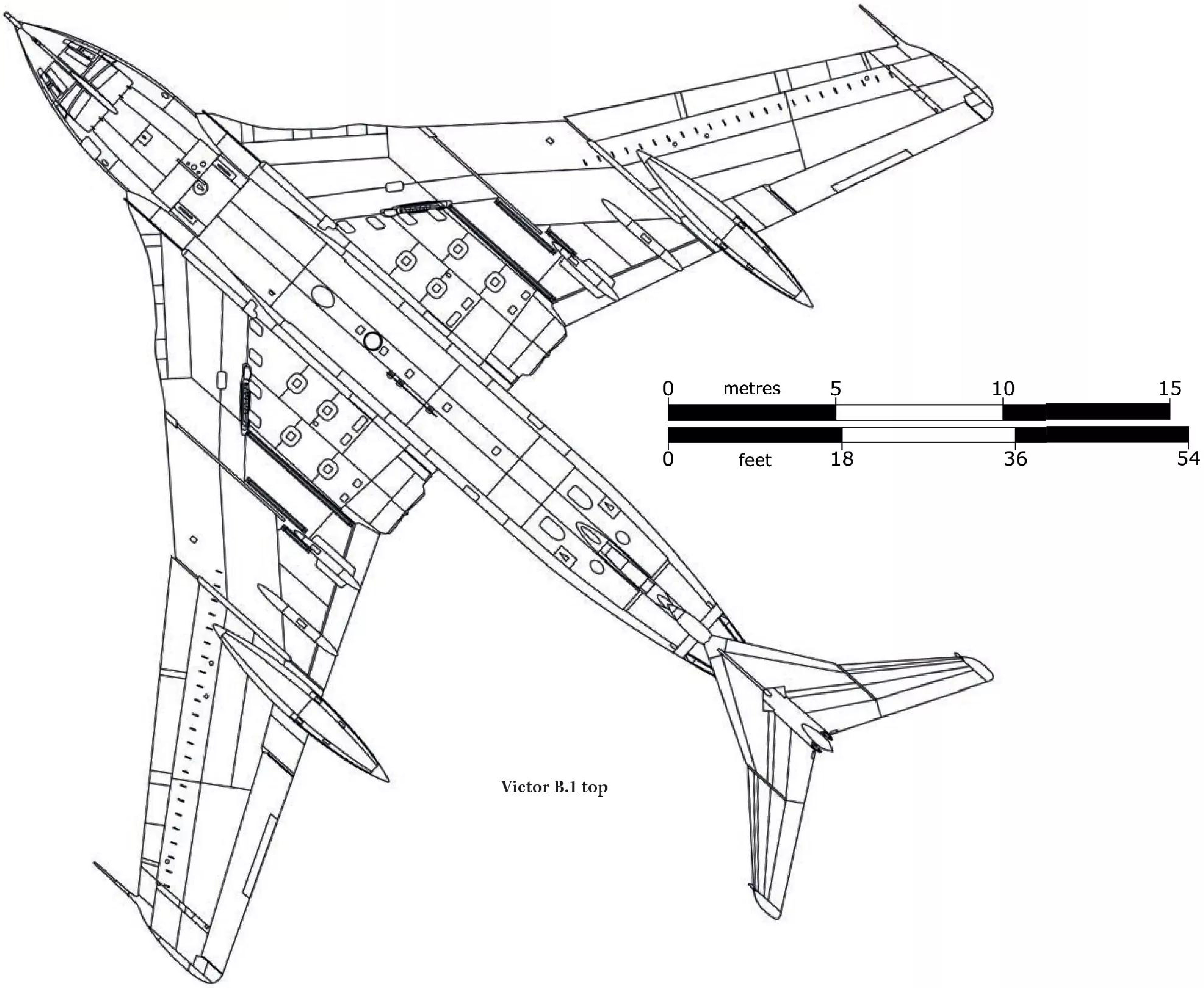


Victor B.1 top

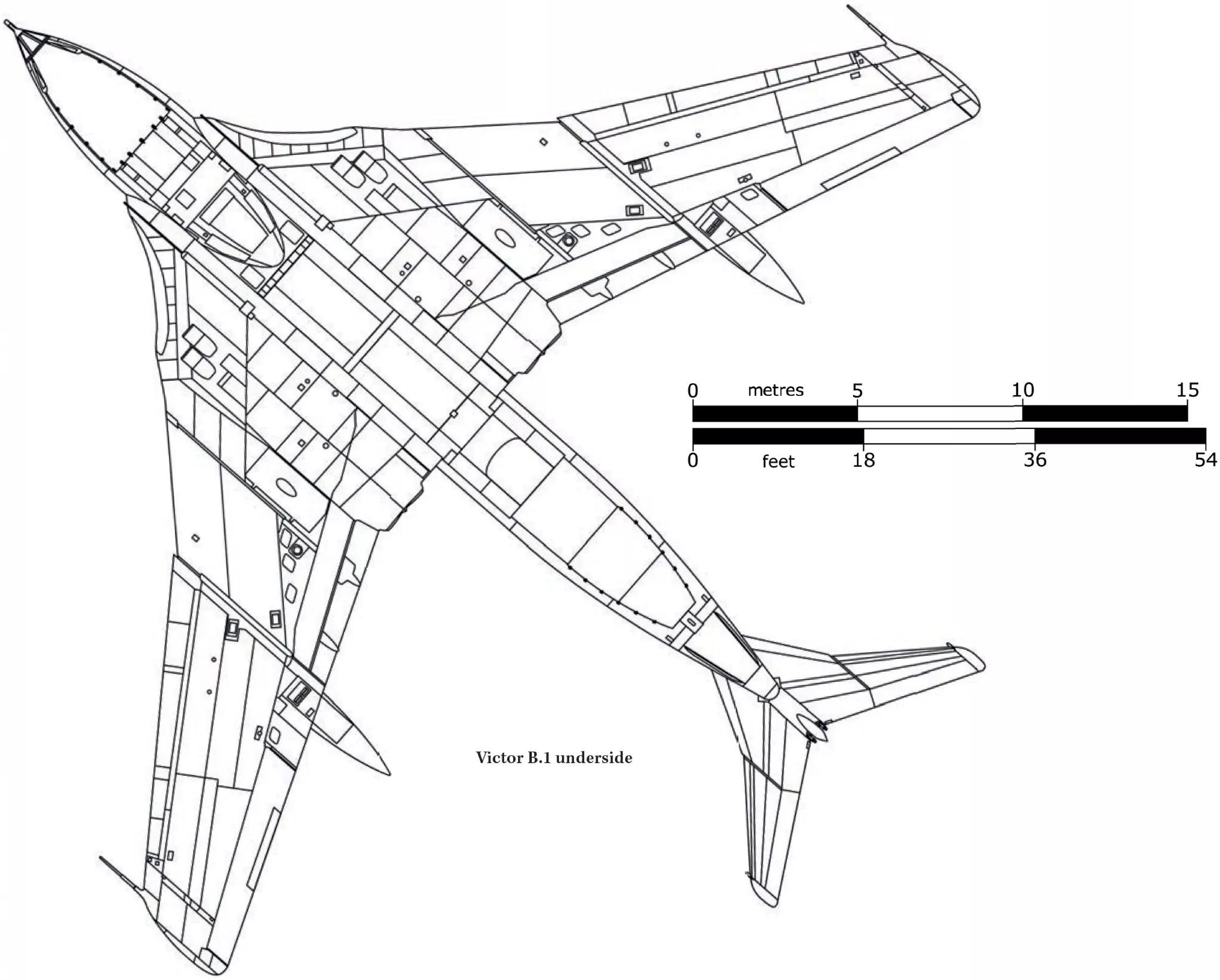
Once again advances in Soviet SAM technology forced the pace of aircraft design in the UK. The Victor B.2 was conceived in the belief that altitude would still allow bombers to evade missiles. Initially, it was proposed that the wing would be redesigned and six Sapphire ASSa.9 engines would be fitted, the engine being developed for an aerodynamically refined Javelin variant, known literally as the Thin Wing Javelin. With the cancellation of that project however, Handley Page had to opt for the Rolls-Royce Conway R.Co.11 to supply the extra power required.

The Victor had been designed to carry Britain's nuclear weapons: Blue Danube, Yellow Sun and later the Blue Steel stand-off missile, which due to the size and the low clearance of the Victor bomb bay made loading a challenge. Blue Steel also had reliability issues and was only seen as a short term nuclear deterrent. The Victor's days as a nuclear bomber were clearly numbered but its service life was extended with the retirement of the Valiant fleet and the need for a replacement tanker however.

Naturally, if the Valiant could do it so could the Victor and the type was converted. Trials began in 1964 when XA918 was adapted and tested for suitability. By May 1965, six had been successfully converted, two drogues fitted to the wings and a third in the fuselage. 55 Squadron became a combined bomber and tanker squadron at RAF Marham, this henceforth being the home of the Victor tanker fleet for many years.

As the Mk.Is came to the end of their flying hours they were replaced with the B.2s. By now the nuclear bomber concept was becoming obsolete and the role of nuclear deterrent was taken over by the Royal Navy's submarine fleet. During the Falklands War of 1982, the tanker fleet was required to undertake the longest mission involving refuelling ever contemplated and the planning required was extensive.

To stop the Argentines basing their fast jets at Port Stanley, the runway needed to be taken out of the equation. The Vulcan was chosen for the job but it would need to make an 8,000 mile journey and for this 11 tankers were required. Several of the Victors used were just to refuel other Victors and



Victor B.1 underside

give them the range to refuel the Vulcans. A total of five raids were flown, two more were planned but aborted, one due to weather and the other due to a fault with the tankers.

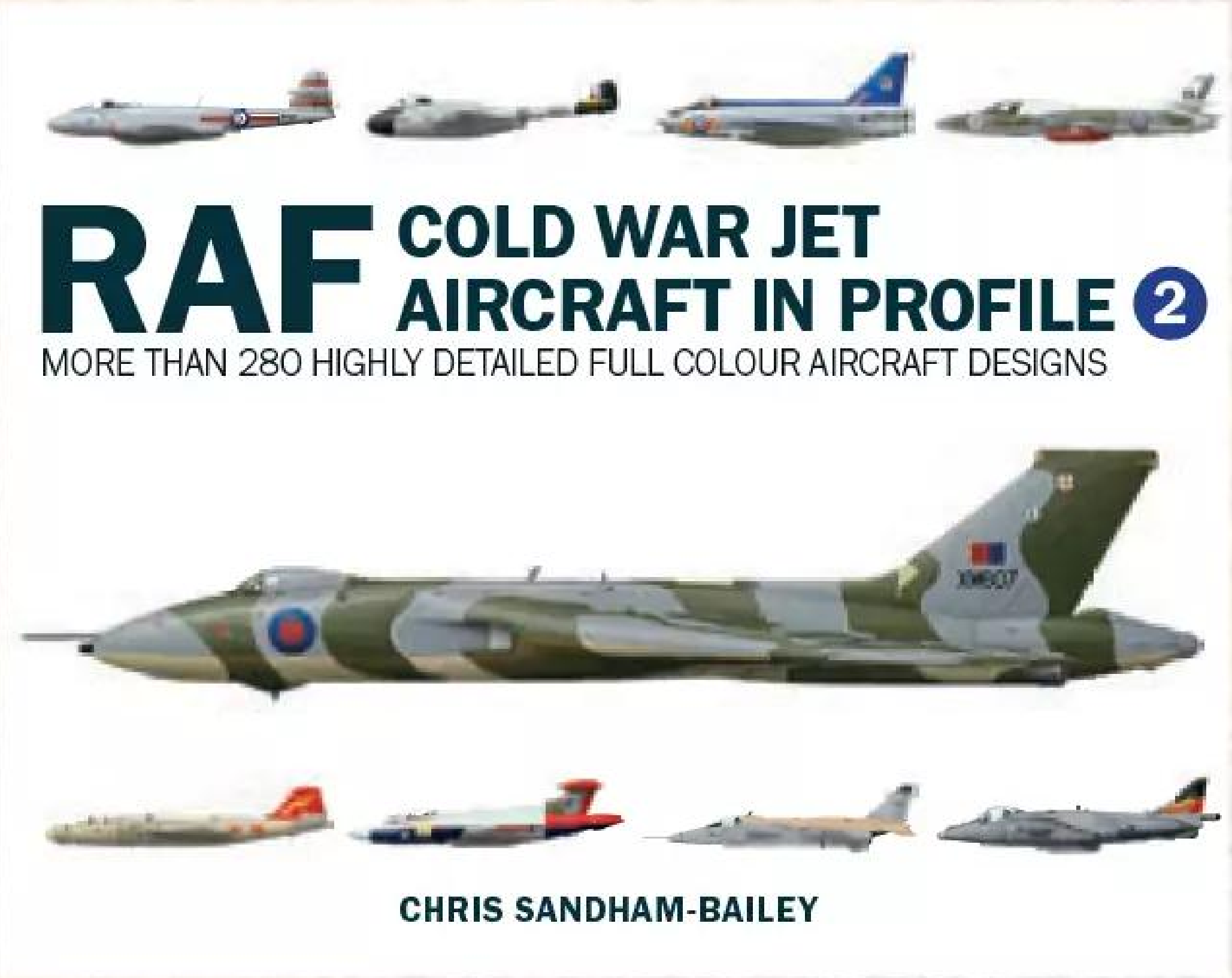
Victors were also involved in Operation Granby and Desert Storm during 1990/1991 when 10 Victors were painted in a hemp scheme and sent to the Gulf region. The original plan was only to support RAF Jaguars and Tornado F.3s, VC10s refuelling the Tornado GR.1s. However, they ended up refuelling Canadian, French, USN and USAF aircraft as well.

Only two years later, on October 15, 1993, the last Victor unit, 55 Squadron, was disbanded and the aircraft dispersed to museums or scrapped.

The Victor was a highly flexible aircraft, which explains its remarkable longevity. Adapting it to new roles saved money and at one stage it was even considered as a troop transporter — with transport pods fitted under the wings and a third in the bomb bay. Perhaps fortunately for the troops, this concept never made it off the drawing board.

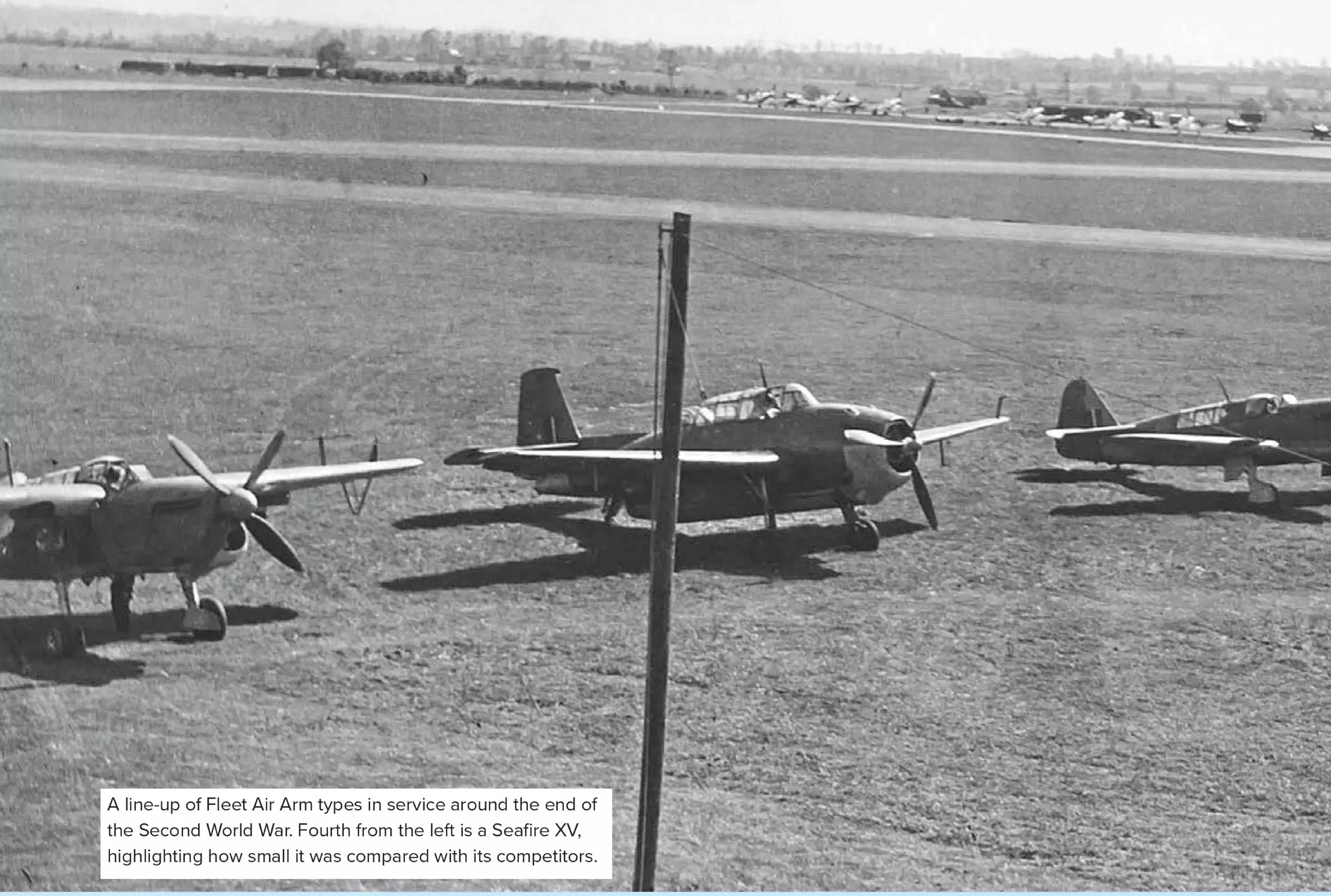
Like so many other Cold War aircraft, several examples are preserved and two are still in taxiable condition: XL231 Lusty Lindy at the Yorkshire Air Museum (recently repainted, see last issue) and XM715 Teasin' Tina at Bruntingthorpe. The latter made the last unofficial flight of a Victor when a miscommunication led to an inadvertent short hop during a high-speed run on May 3, 2009. ■

For more, see:
RAF Cold War Jet Aircraft in Profile
By **Chris Sandham-Bailey**
Published by **Mortons Media Group**
Hardback: Price on MortonsBooks.co.uk
£35

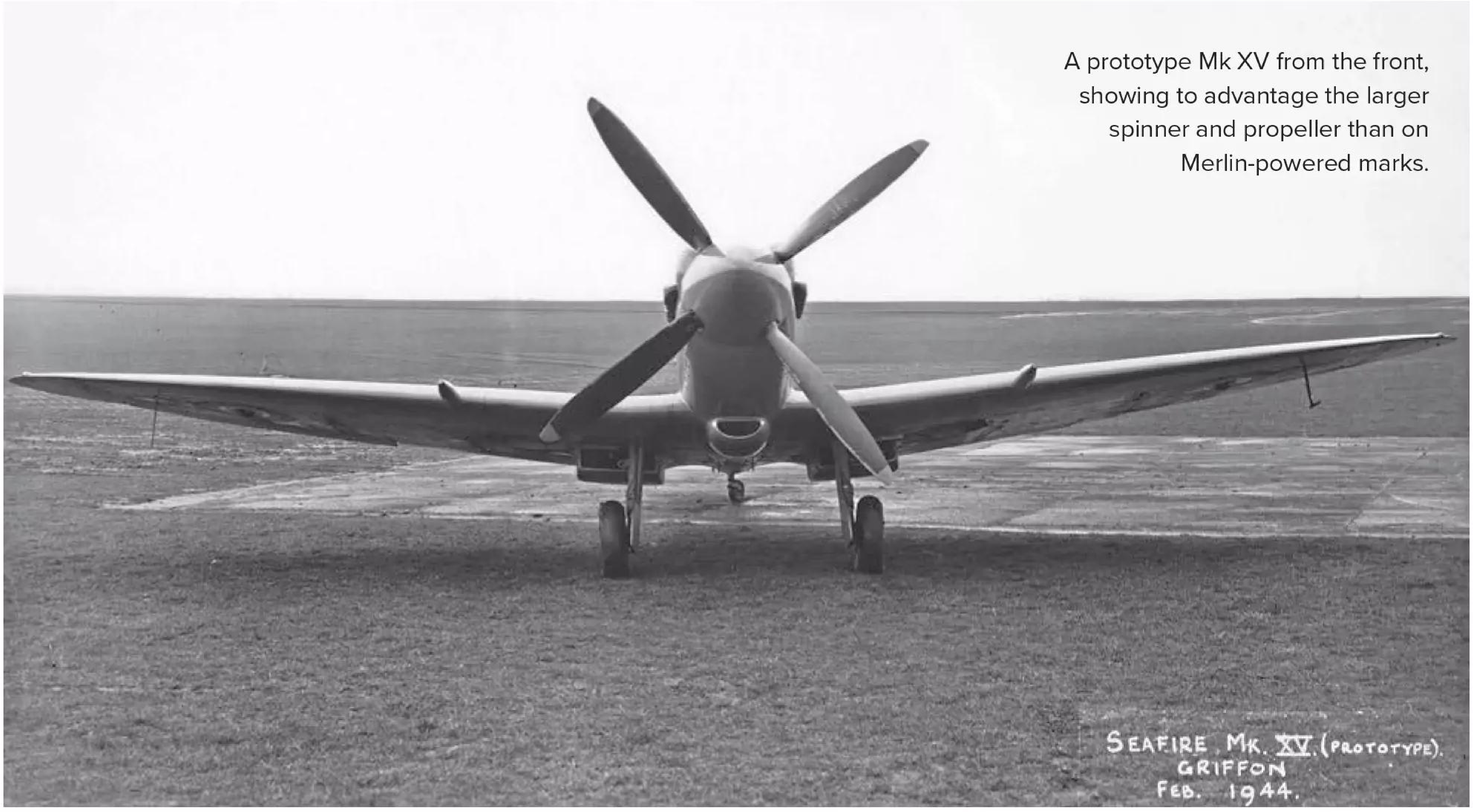

RAF COLD WAR JET AIRCRAFT IN PROFILE 2
MORE THAN 280 HIGHLY DETAILED FULL COLOUR AIRCRAFT DESIGNS
CHRIS SANDHAM-BAILEY

Did the Griffon have too much power?

In a word, 'yes' early Griffon Seafires did have too much power, making the aircraft difficult to handle especially during take-off and landing from aircraft carriers. The engine's powerful, anti-clockwise rotating propeller created huge amounts of torque that made the airframe want to rotate clockwise, plus the rotation of the propeller also affected the right wing's lift which could lead to a stall. A solution was found in the form of a six-bladed contra-rotating propeller. This design cancelled out the torque by using two sets of blades rotating in opposite directions, allowing the aircraft to handle the power of the Griffon engine.



A line-up of Fleet Air Arm types in service around the end of the Second World War. Fourth from the left is a Seafire XV, highlighting how small it was compared with its competitors.



A prototype Mk XV from the front, showing to advantage the larger spinner and propeller than on Merlin-powered marks.

The idea of a carrier-capable Spitfire powered by the Rolls-Royce Griffon went back to the earliest proposals. This was a natural development – the Griffon was originally commissioned by the Admiralty. Supermarine drew up a proposal in January 1943 for a Griffon Seafire with substantial similarities to existing variants.

Specification N.4/43 was issued on 31 August 1943, calling for three prototype and three pre-production Griffon Seafires. Existing jigs and tooling were to be used wherever possible. The resulting Seafire Mk XV used the forward fuselage from the Spitfire XII, the centre fuselage and wings from the Seafire III, and the rear fuselage and tail from the Spitfire VIII (with a distinctive enlarged trim tab). The engine was a Griffon VI. Interestingly, the specification required best performance between 8,000 and 25,000 feet altitude. The aircraft would have increased fuel capacity over the Mk III, and a specially designed teardrop-shaped external tank to boot, as well as a redesigned cooling system.

The first prototype, NS487, was tested at Boscombe Down from March 1944, and flew 12 hours 25 minutes at the establishment. The A&AEE report noted that "The finish of the aircraft was very good. The skin was flush-riveted throughout, all joints were filled with compound, and the whole aircraft was polished to give a smooth surface."[1] Handling trials

➤

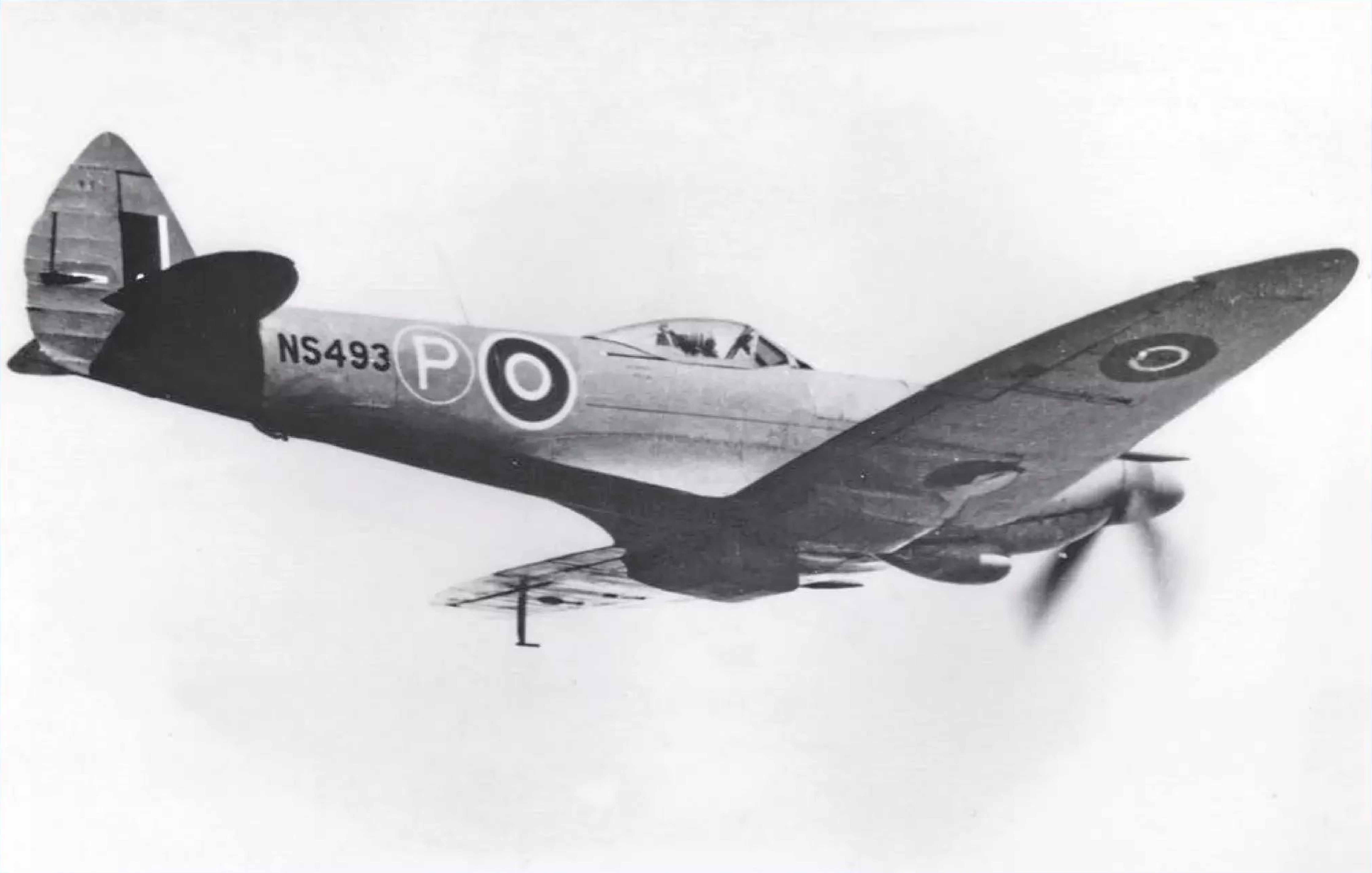
The Seafire XV used the same undercarriage as the Mk III despite it being somewhat heavier, meaning the type was even more prone to undercarriage collapses.

concluded, "The handling characteristics of the Seafire XV are satisfactory," adding, "The aircraft is considered to be suitable for carrier operation and no undue difficulty should be experienced … normal deck-landing technique can be used, though this is slightly more difficult than on previous Seafire aircraft." The maximum speed reached at the establishment was 395mph at 12,800 feet, by the third prototype, NS493 after it had been rebuilt with a low back and 'bubble' canopy. The 'cutting down' of the fuselage aft did not have any adverse effect on in-flight behaviour.

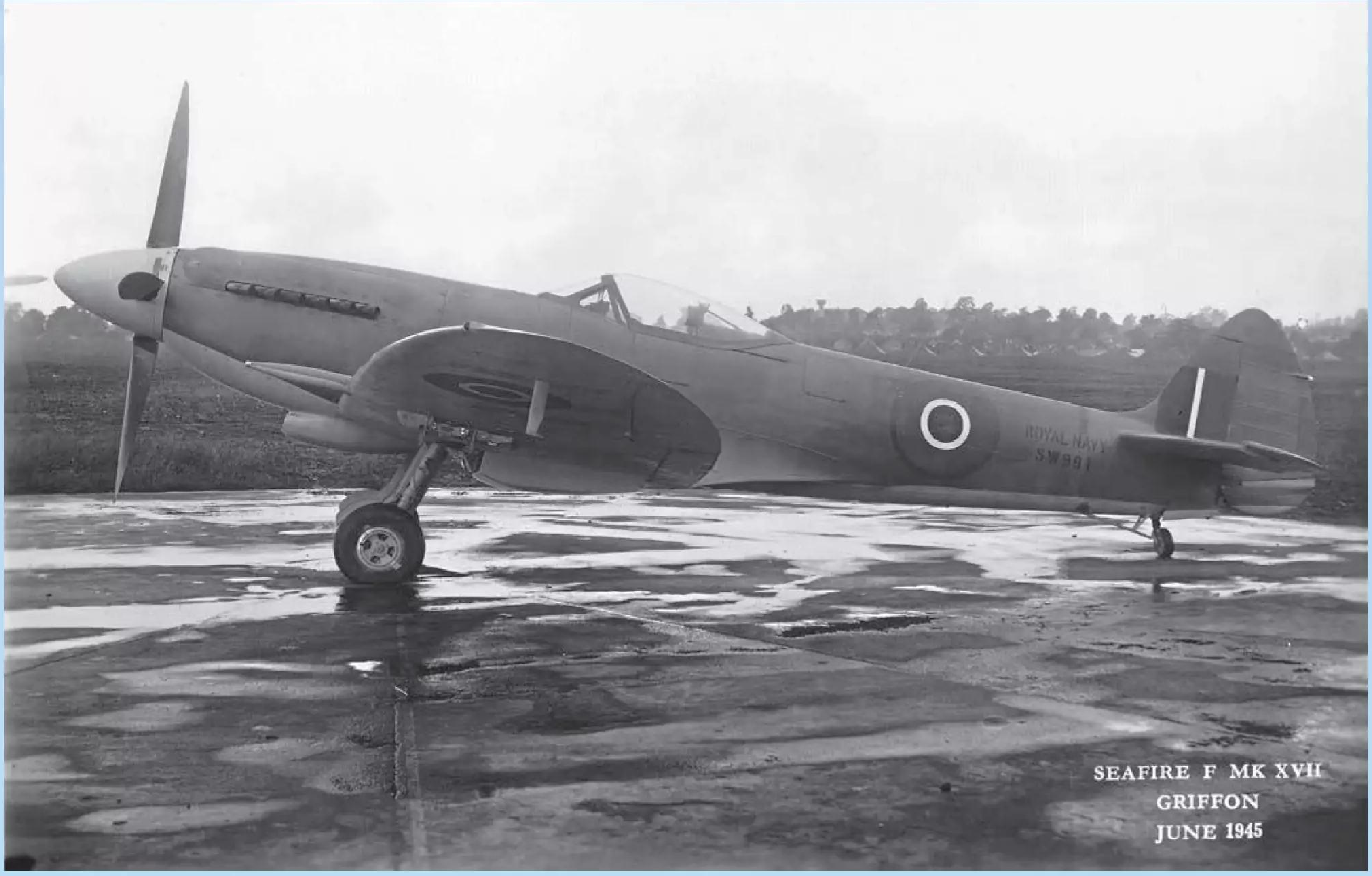
The switch to a 'bubble' canopy and the introduction of other improvements such as a long-stroke, more softly damped undercarriage, a 24-volt electrical system replacing the old 12-volt, and a rear fuselage fuel tank necessitated a change of mark number to XVII. NS493 was treated as the prototype Mk XVII, though it did not have all the requisite modifications. This mark was the only member of the entire Spitfire/Seafire family to couple the cut-down rear fuselage with the short-block Griffon, giving it a unique look. Mk XVIIs started to be delivered from late 1945.

The first-production Mk XV was SR446, which was tested at the A&AEE from the end of November 1944, and as with the Mk III, its behaviour was markedly poorer than the prototype's. The ailerons on SR446 "exhibited certain undesirable characteristics". As speed increased, the Seafire began to fly left-wing low, with 'upfloat' noticed on the starboard aileron. Above 360mph the tendency became ever more apparent until at 450mph (indicated), the pilot had to exert a 10-lb force on the stick just to keep the aircraft level, and when banking to the right, the elevator vibrated.

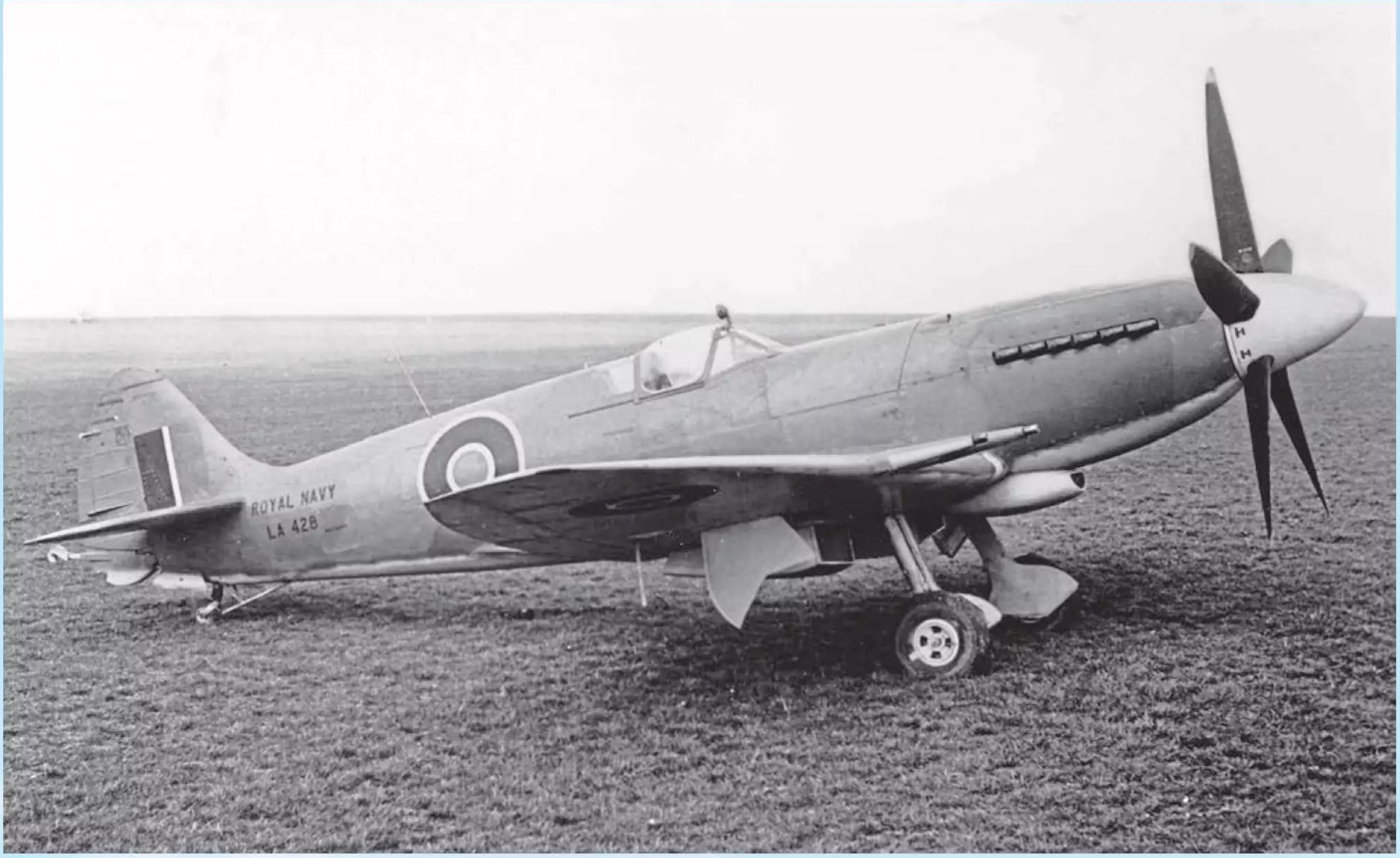
The report concluded, "On the basis of these qualitative tests, the aircraft was ➤



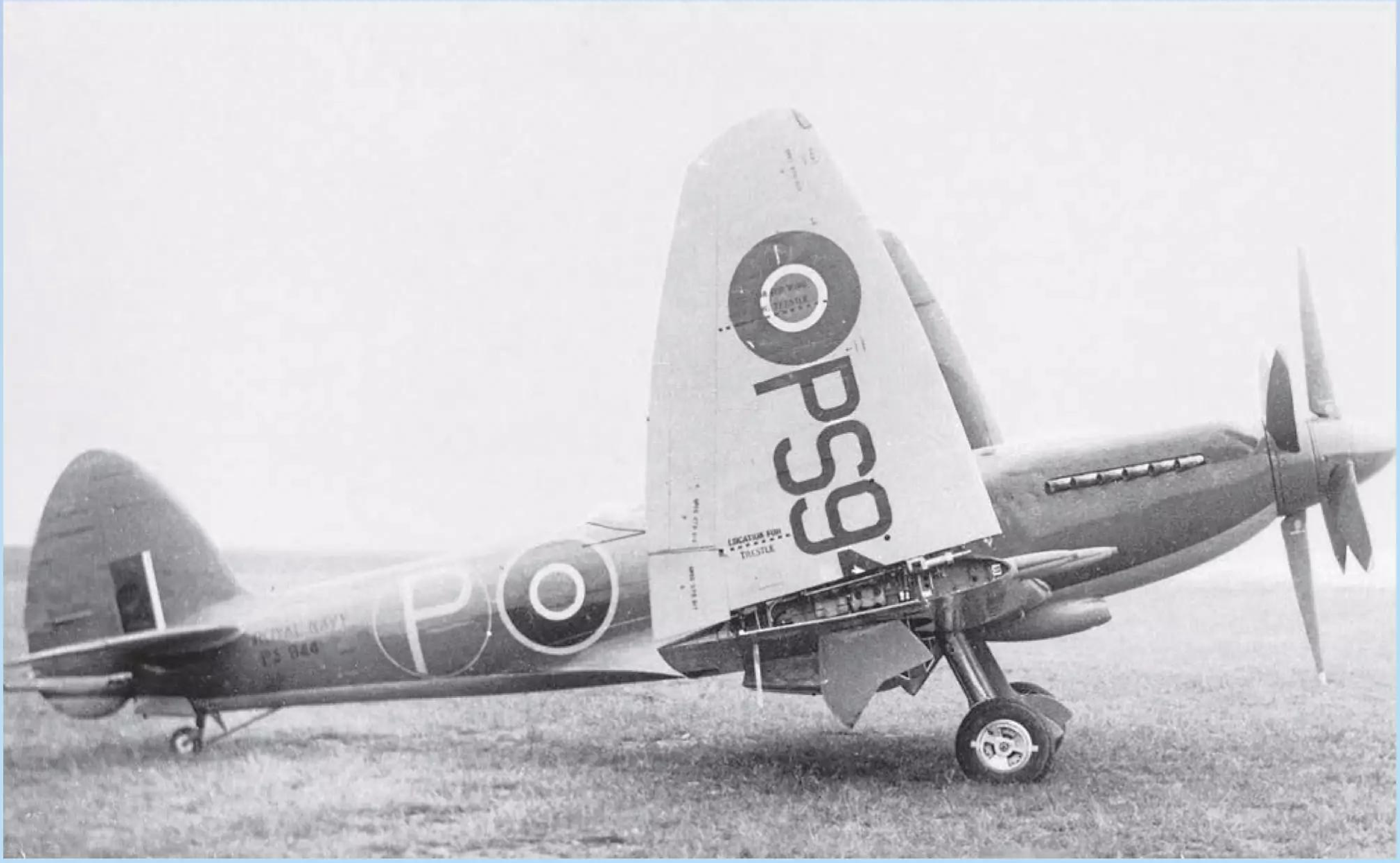
The unsatisfactory features of the Mk XV led almost immediately to development of the improved Mk XVII. Mk XV prototype NS493 was modified with a cut-down fuselage and bubble canopy in 1944.


ROYAL NAVY
SW991
SEAFIRE F MK XVII
GRIFFON
JUNE 1945

The sixth production Mk XVII, SW991, in June 1945. This mark had improved undercarriage, cockpit canopy and electrical system, and carried more internal fuel.


ROYAL NAVY
LA 428

The prototype of a third Griffon mark of Seafire first flew some six months before the end of the war – LA428, the first prototype Mk 45, based on the much revamped Spitfire 21.



The 'prototype' Mk 47 was the first production aircraft, PS944 – no true prototype was needed as the Mk 47 was so similar to the preceding Mk 46 (the Seafire 45, 46 and 47 shared the same Supermarine Type Number, 388). Note the different style of wing fold to earlier aircraft, with the hinge point further out and no folding tips.

considered unsatisfactory for Service use at this loading." As well as the alarming aileron upfloat, the test pilots remarked that with flaps and undercarriage down there was not enough drag for a deck landing aircraft, and small applications of rudder caused large changes in yaw and longitudinal pitching. Tests of another aircraft, SR448, did not show the same unfortunate tendency, and the A&AEE reluctantly approved the aircraft for service providing the ailerons were all as SR448's were. Trials with a 'sting' arrestor hook (see above) resulted in this development being introduced from the 51st Mk XV. The hook housing was hinged to the rudder post and took up space previously occupied by the lower part of the rudder. As a result, the sting hook required a fin and rudder to a similar profile but slightly larger all round.

Unfortunately, the need for the aircraft in service was so great that a number of early production Seafire XVs were sent to operational squadrons still exhibiting the problems found on SR446. Modifications were introduced on the production line and in the field. A total of 389 Mk XVs were built, and 233 Mk XVIIs.

At the beginning of 1944, the heavily updated Spitfire Mk 21, or Victor as it was initially called, was already being considered for conversion to naval use. A data sheet dated 25 January 1944 [2] lists characteristics for the 'Spitfire 21 Victor Navalised', including folding wings. When a naval version of this mark was developed, the F 45, it lacked the folding wing and although navalised in other respects, and carrying out many deck-landings during trials, it operated only from shore bases in second-line squadrons. The standard five-blade propeller led to serious swing on take-off and was changed for a six-blade contra-rotating unit in April 1945. Fifty-one Mk 45s were built.

A similar conversion of the Spitfire Mk 22 led to the Seafire F 46. This had the 'low back' fuselage and a larger fin and rudder, with contra-props fitted to all 26 aircraft built, the first flying in October 1945. Again, this lacked a folding wing and was not used operationally. The definitive version of the late Seafire was the Mk 47, corresponding to the Spitfire 24. ■

[1] A&AEE: Seafire F Mk XV NS487 (Griffon VI) Handling trials, April 1944, National Archives file AVIA 18/736.

[2] Spitfire 21 Victor Navalised, Aircraft Data Sheet, National Archives file SUPP 9/1.

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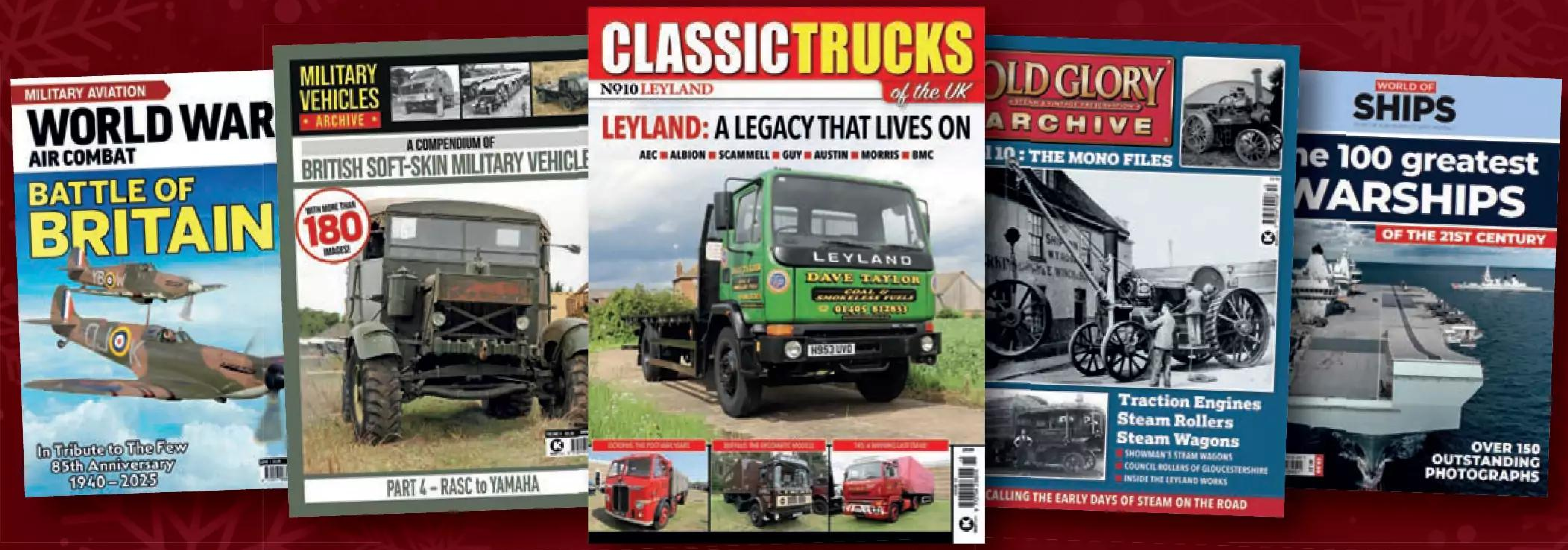
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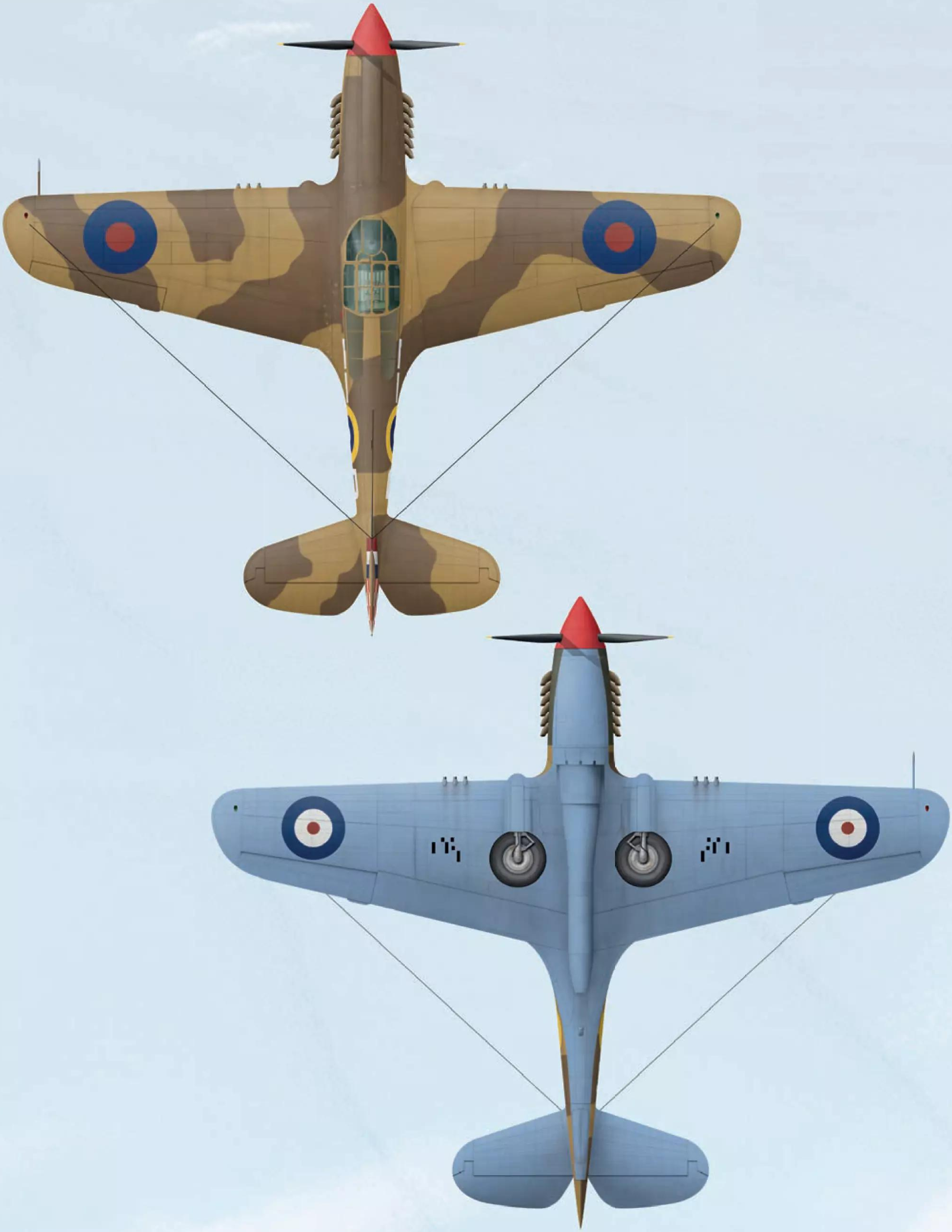


P-40 Kittyhawk Mk.I AK579 FZ-R 94 Squadron
For a brief period during March 1942, the squadron applied red and white checks to the tail. AK579 also served with 450 Sqn RAAF and 2 Sqn SAAF before being struck off charge in June 1943.

P-40D
Curtiss Kittyhawk

As the Second World War progressed, the Allison V-1717-33 engined Tomahawk underwent significant development, leading to its redesignation as the Kittyhawk, while retaining the P-40 code. Like its predecessor, the Kittyhawk was produced in large numbers. Although it was not well suited to Western European conditions, it proved highly effective in other theaters during the Second World War. The Kittyhawk is most closely associated with operations in North Africa by the RAF and Commonwealth forces.

The P-40D (Mark I) was produced by Curtiss in an effort to improve performance. It was visibly different to the Tomahawk due to the fuselage cross section being reduced in an effort to cut drag. It also had the strength to carry a centreline 500lb bomb or external tank as well as a 100lb bomb under each wing. The nose guns were removed and after the first 20 were completed two more Browning .50 cal guns were mounted in the wings to compensate. The number of rounds was increased to 615 per gun, providing greater firepower and for longer. British aircraft had their rear cockpit windows changed in size and shape to improve rear visibility for the pilot.

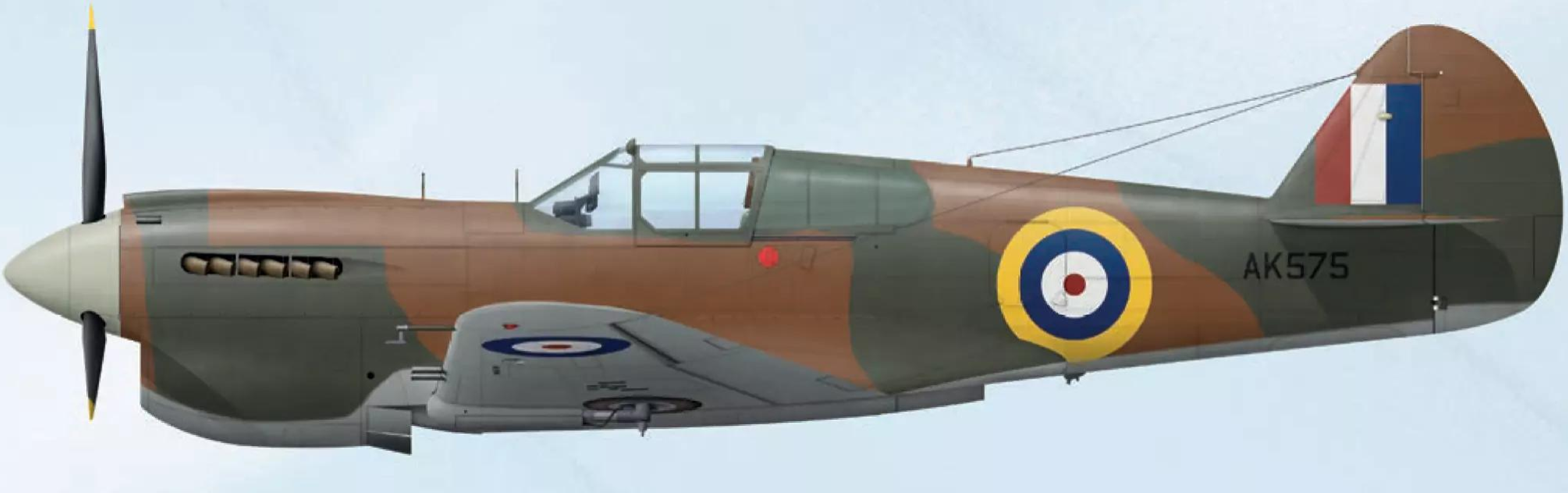
He also benefitted from the introduction of armour plating. The biggest change however was dictated by the engine. The V 1710-33 used an internal reduction gearbox but this could only handle a maximum of 1100hp and the engine put out 1090hp. The V-1710-39 produced 1150hp so the gearing was altered and an external reduction gearbox was fitted in place. This made the engine shorter and raised the thrust line. To accommodate the V-1710-39, the nose was redesigned with a higher propeller and a deeper scoop but it also allowed for the main undercarriage legs to be shortened.

Despite the extra power generated by the engine the performance did not significantly improve due to the increase in weight caused by the other alterations.

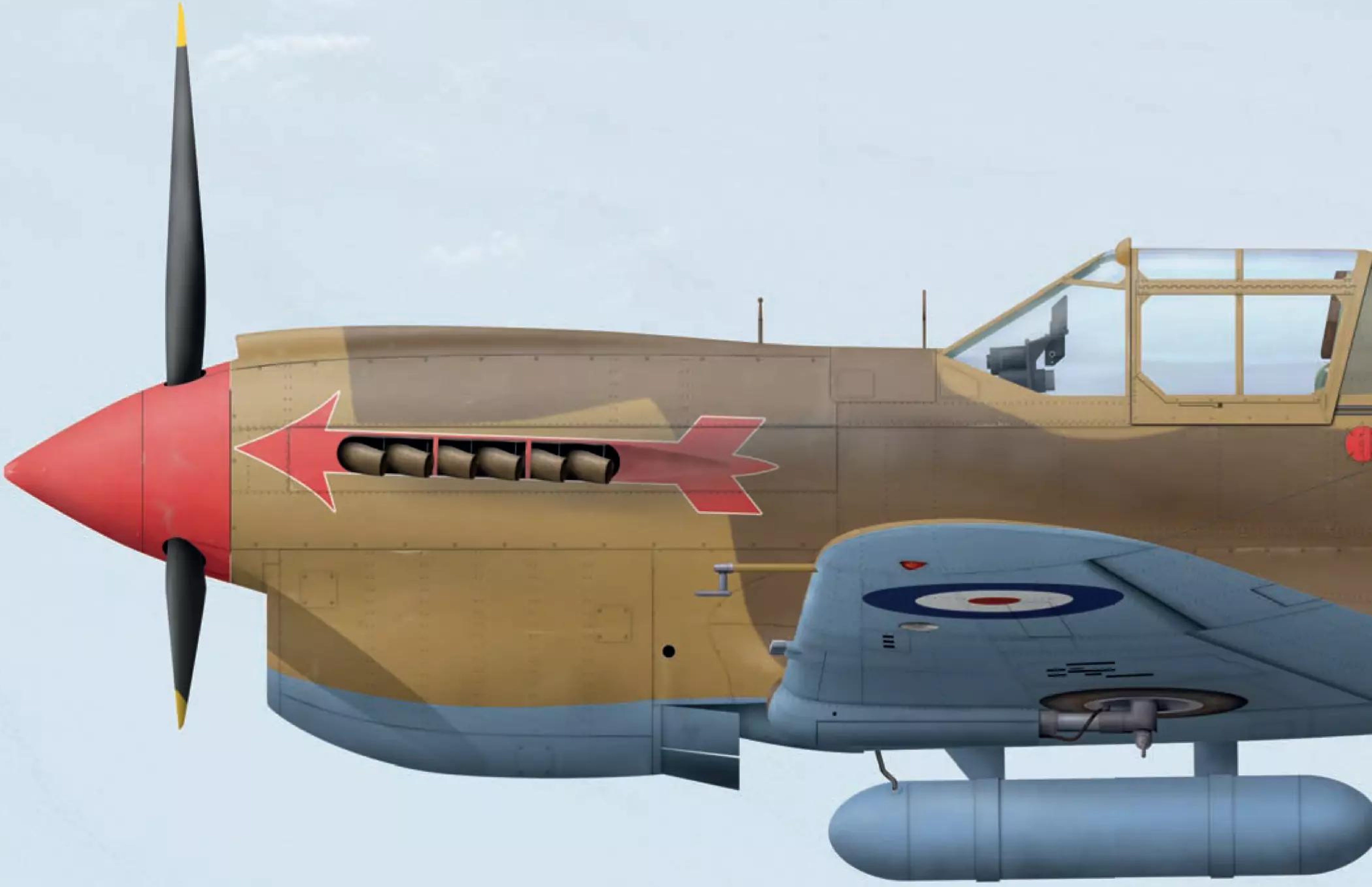
The Packard Merlin which had recently begun production in the US was of a similar size to the Allison engine so it could be fitted with no major redesign of the nose. The only external difference was the removal of the carburettor air intake on the top, the Merlin instead having the air diverted from the main intake. The change of engine improved the speed from 354mph at 1500ft to 364mph at 2000ft. It also had the benefit of being able to carry even heavier external stores.

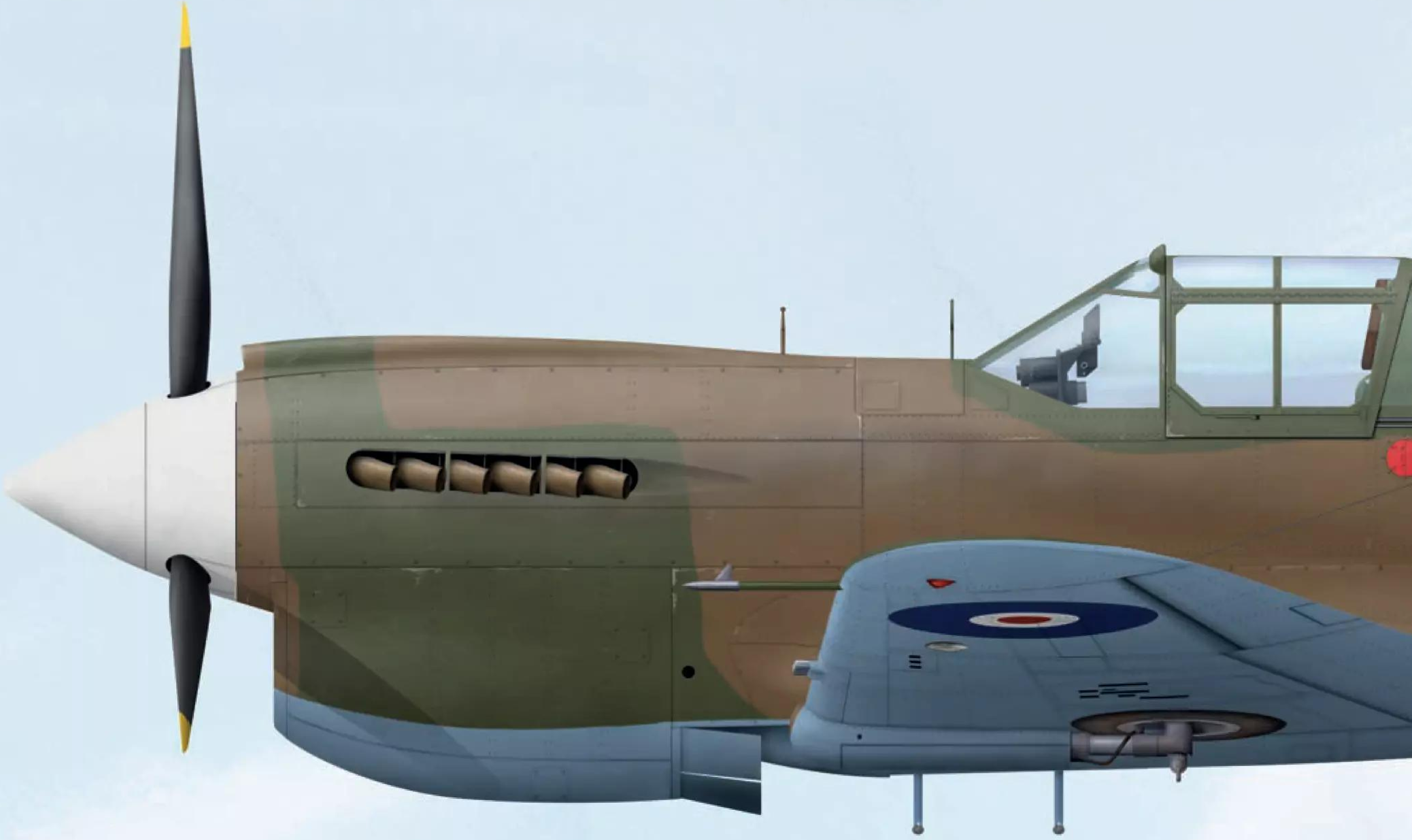
Under the Lend-Lease agreement, a P-40E would be provided at a cost of $59,618 and by the end of the war a total of 3056 Kittyhawks were provided although 300 were diverted to the USSR and some were lost at sea. As the Tomahawk had already proved more suited to desert conditions the only Kittyhawks to be seen in Britain were those delivered to RAF Speke. Apart from a few retained for trials, all were forwarded on to replace the Tomahawks in the fighter and ground-attack roles.

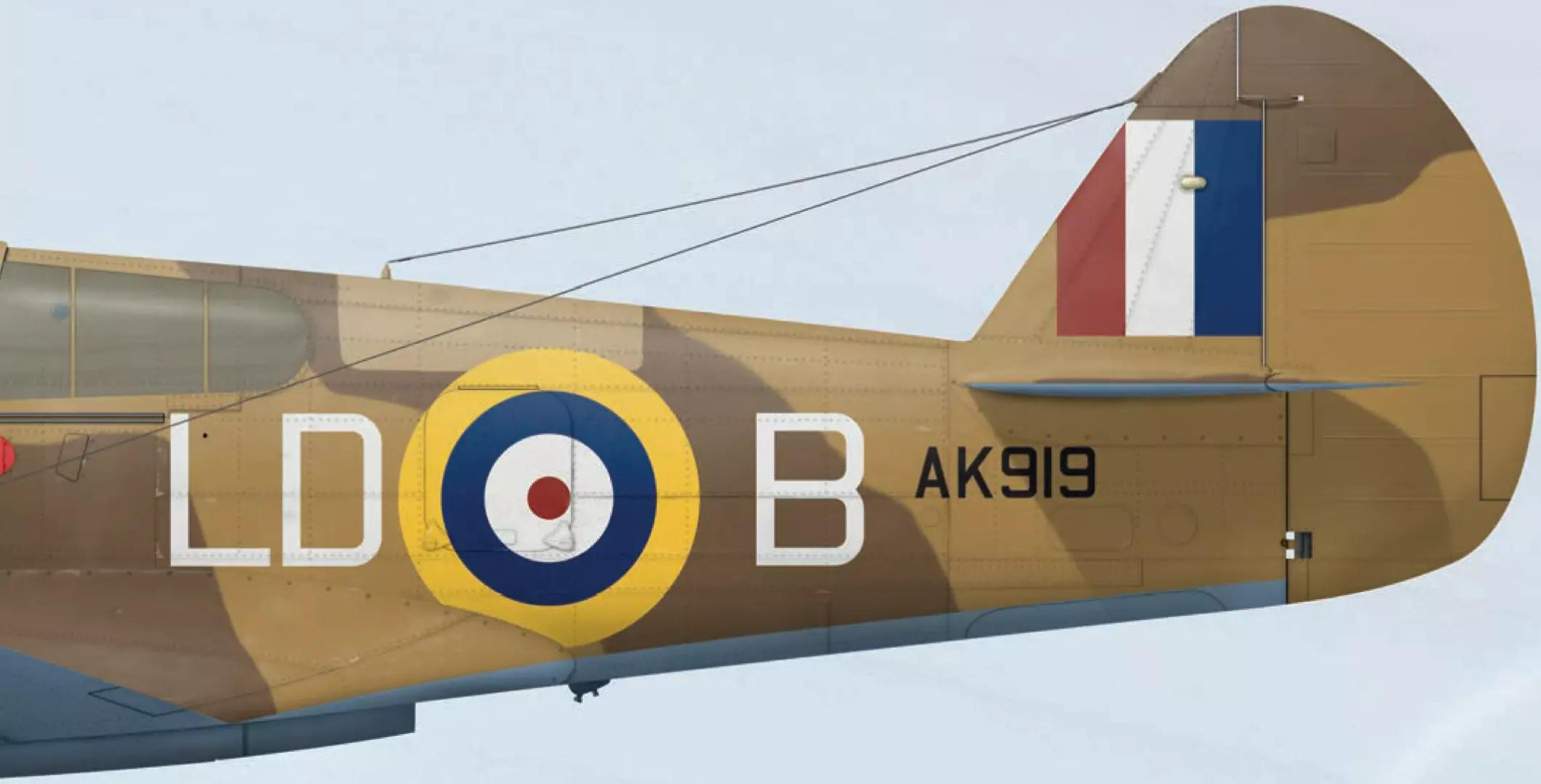
Aircraft began arriving in late 1941 in the Middle East and 3 Squadron RAAF became



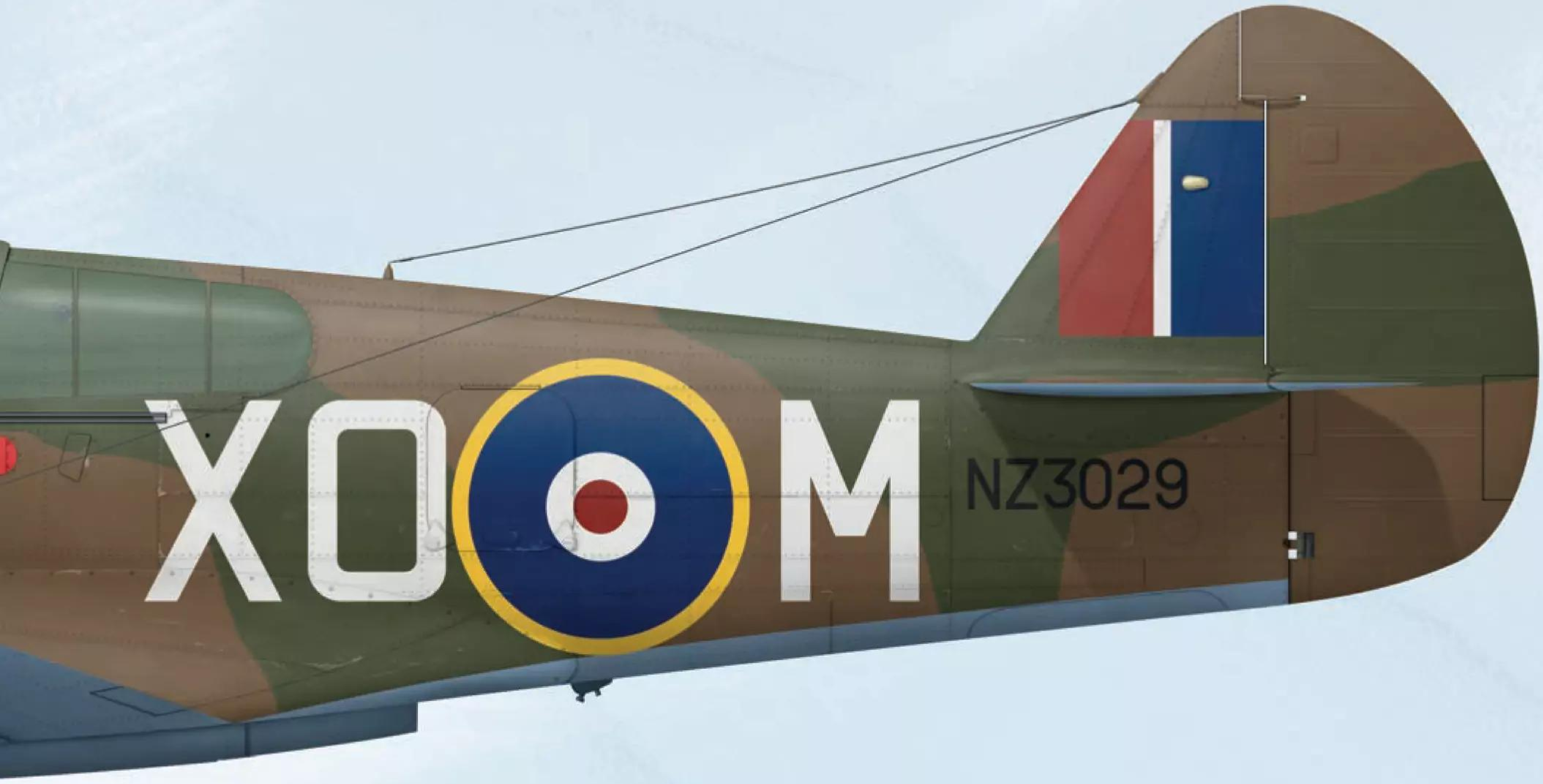
P-40 Kittyhawk Mk.I AK575
Part of the first batch of Kittyhawks delivered to the RAF, AK575 arrived at RAF Speke in December 1941. As the fifth delivered it only had two guns in each wing. Painted in a company version of Dark Green and Dark Earth with Light Grey underside.





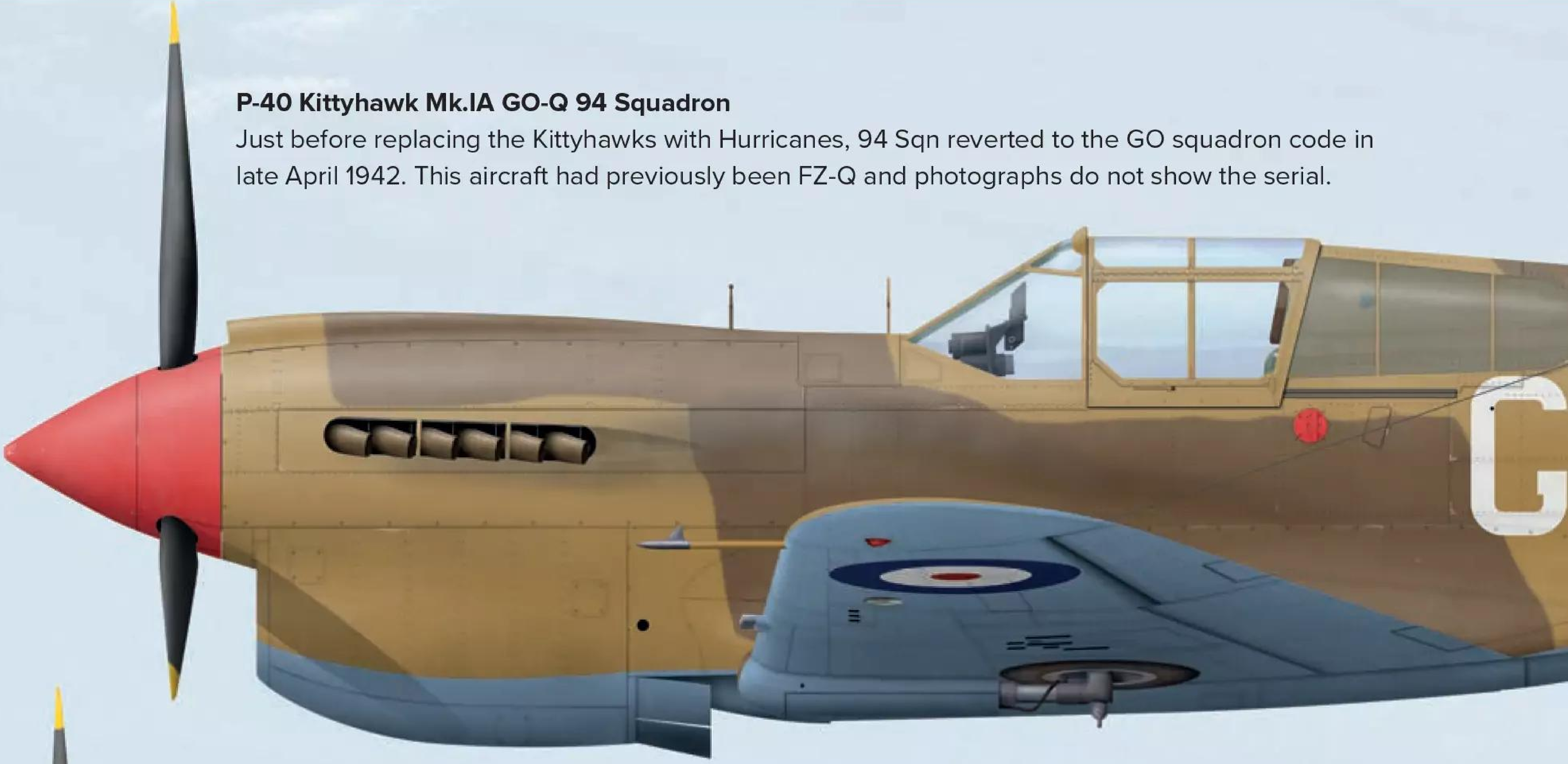


P-40 Kittyhawk Mk.I AK919 LD-B 250 Squadron
Painted in Dark Earth and Mid Stone over Azure, 250 Sqn decorated the nose of their Kittyhawks with a red arrow. AK919 was flown by Sqn Ldr Mike Judd who while squadron CO made four kills.

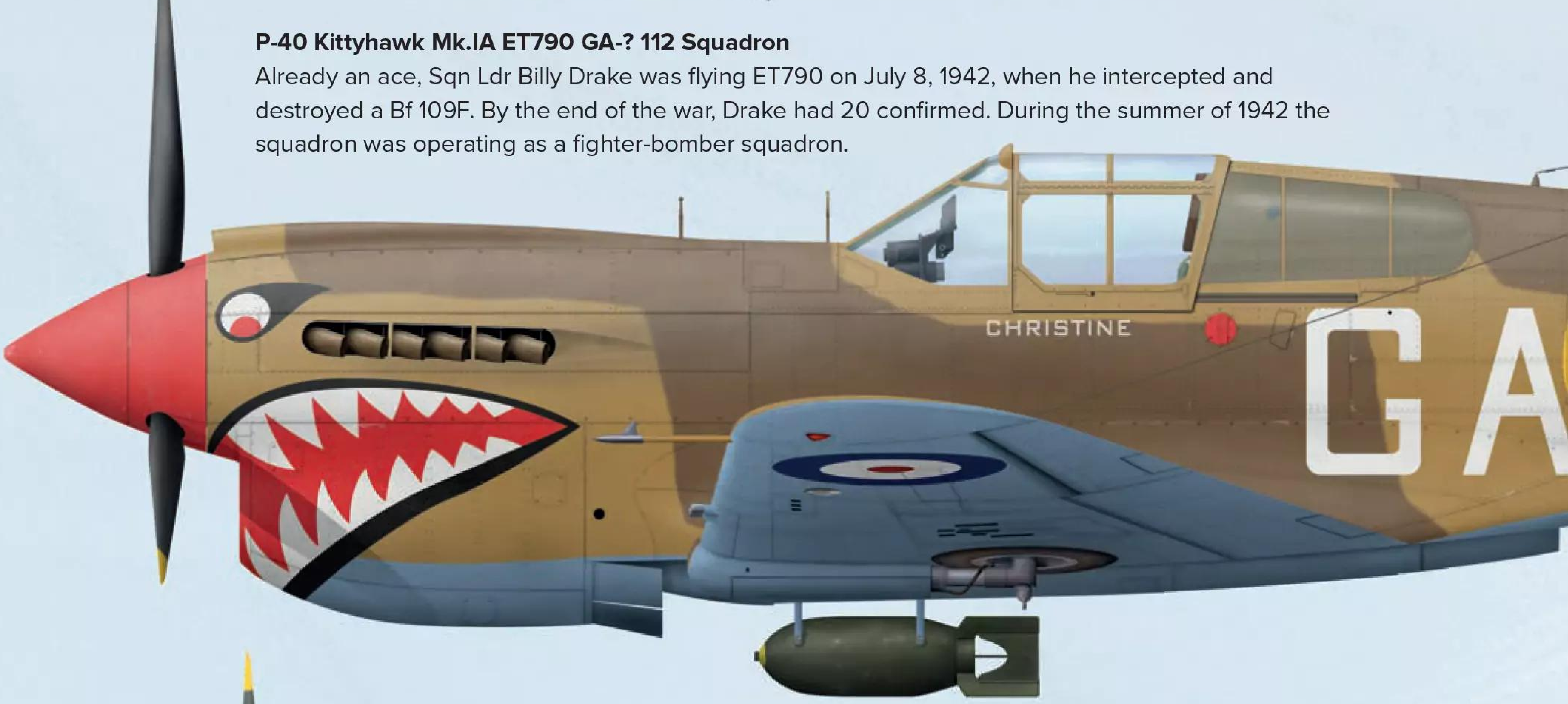


P-40 Kittyhawk Mk.IA NZ3029 XO-M 16 Squadron RAAF
16 Sqn RNZAF was only in existence for a brief period between July 1942 and October 1945, operating first the P-40 followed by the F-4U. NZ3029 was painted in Dark Green and Dark Earth over Sky.

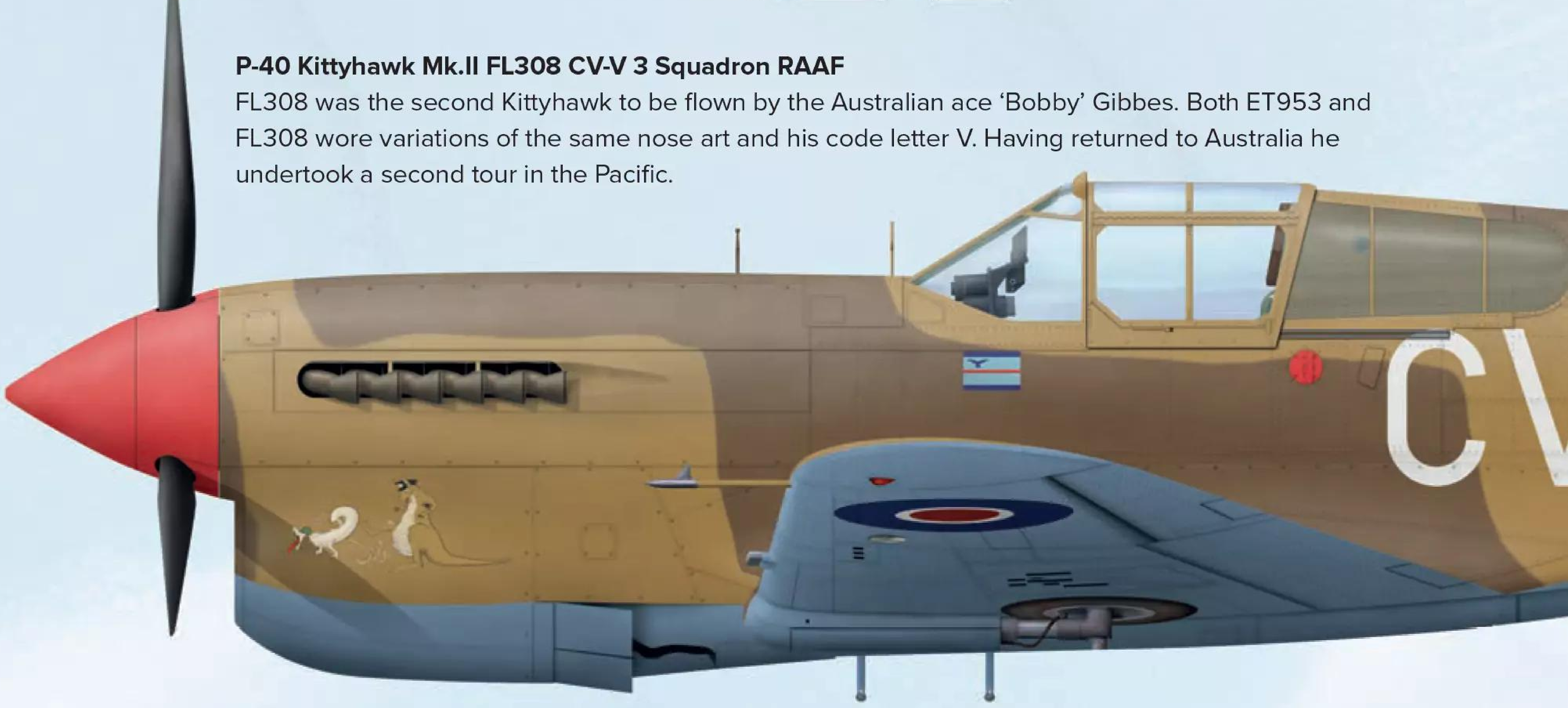
P-40 Kittyhawk Mk.IA GO-Q 94 Squadron
Just before replacing the Kittyhawks with Hurricanes, 94 Sqn reverted to the GO squadron code in late April 1942. This aircraft had previously been FZ-Q and photographs do not show the serial.

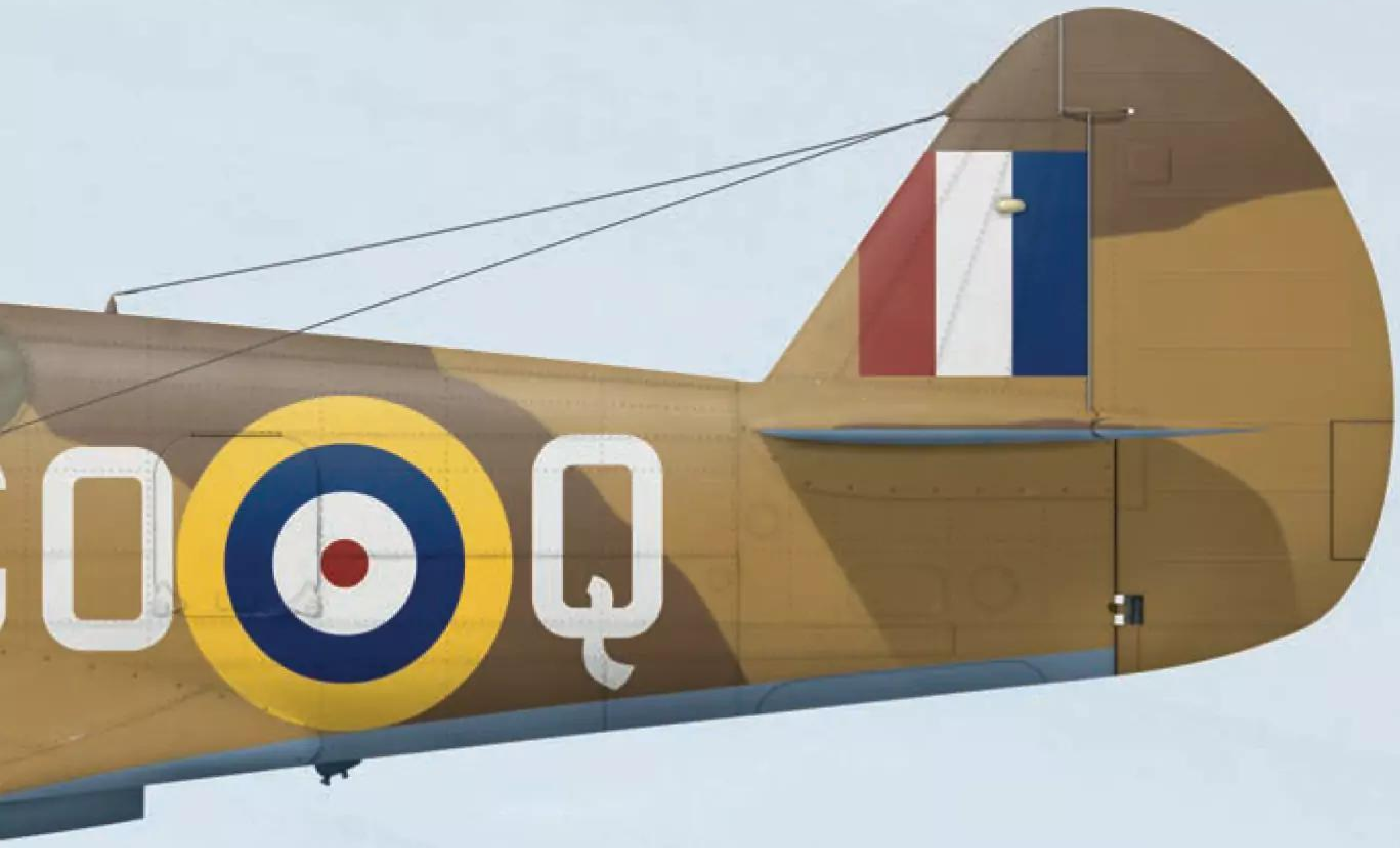


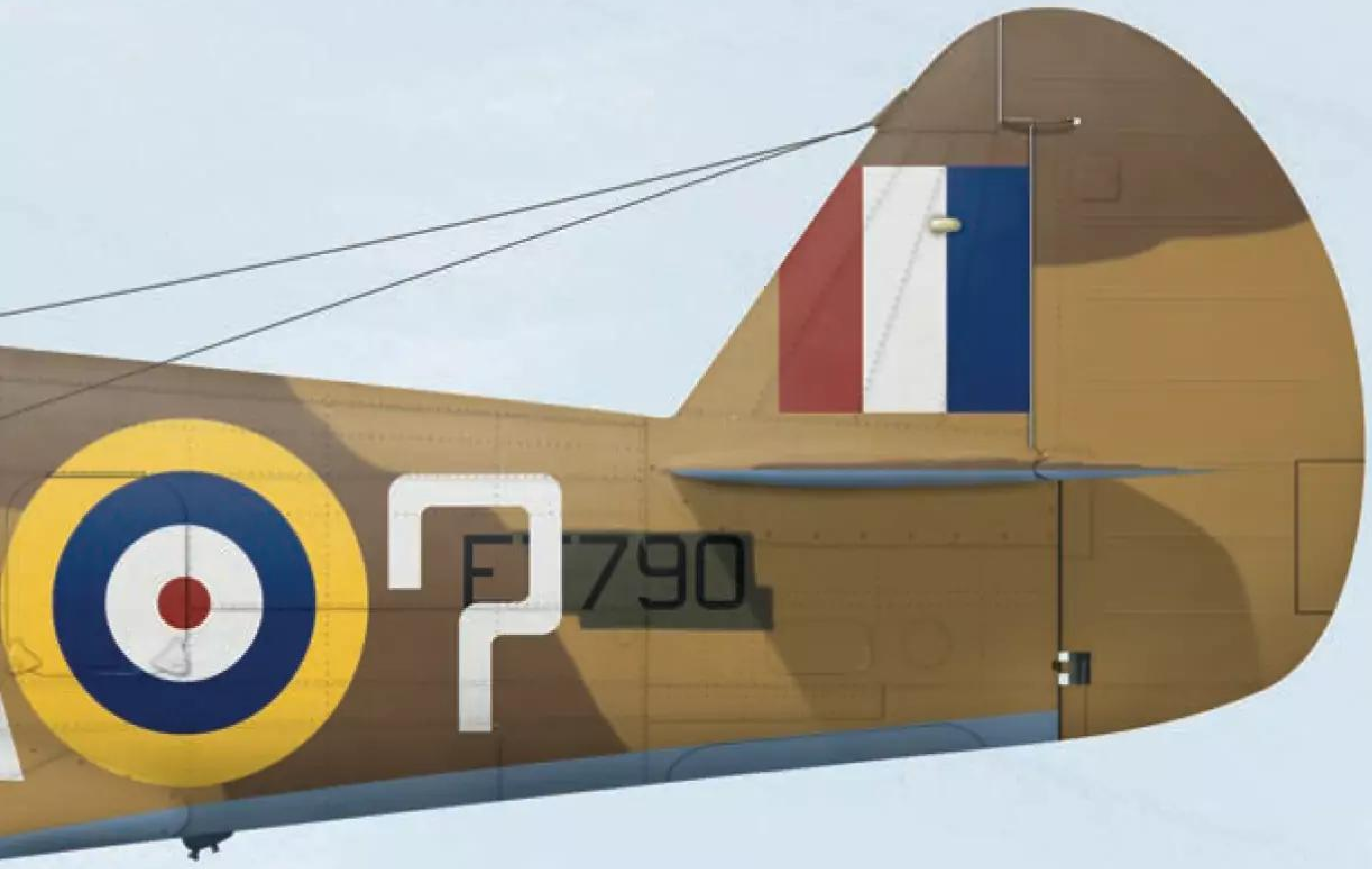
P-40 Kittyhawk Mk.IA ET790 GA-? 112 Squadron
Already an ace, Sqn Ldr Billy Drake was flying ET790 on July 8, 1942, when he intercepted and destroyed a Bf 109F. By the end of the war, Drake had 20 confirmed. During the summer of 1942 the squadron was operating as a fighter-bomber squadron.

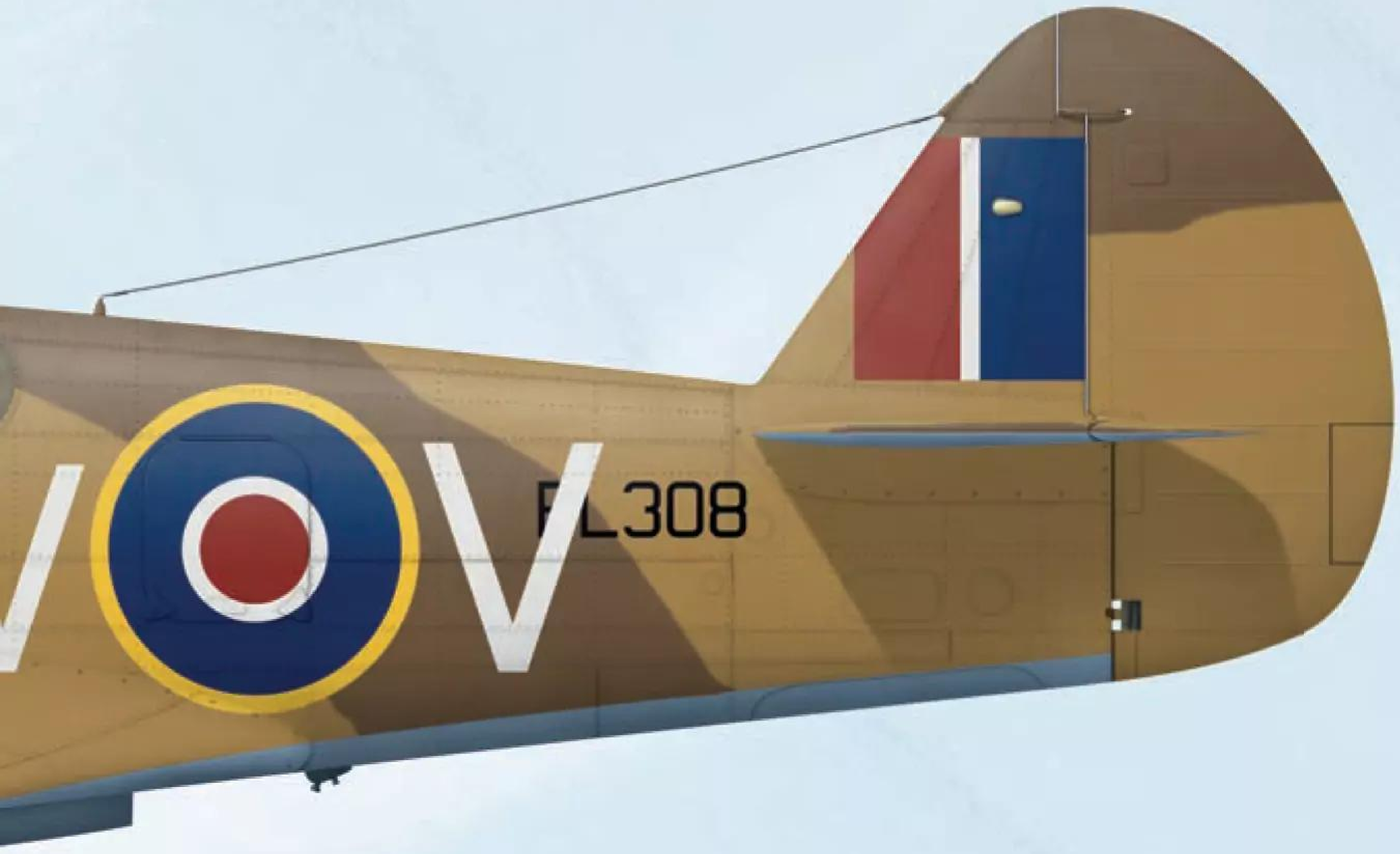


P-40 Kittyhawk Mk.II FL308 CV-V 3 Squadron RAAF
FL308 was the second Kittyhawk to be flown by the Australian ace 'Bobby' Gibbes. Both ET953 and FL308 wore variations of the same nose art and his code letter V. Having returned to Australia he undertook a second tour in the Pacific.









the first Commonwealth unit to operate to the Kittyhawk on December 17, due to similarities in types and the necessities of war there was no conversion process, the squadron soon found itself flying missions and on New Year's Day the squadron's nine P-40Ds destroyed a Bf 109 and a Ju 87, several more were damaged in the fight near Agedabia, Libya.

During January, 112 Squadron became the second Kittyhawk squadron when they also replaced their Tomahawks. Just like 3 Squadron RAAF, 112 Squadron had made a trip to Agedabia when they first used the Kittyhawk in combat. Having escorted a flight of Blenheims tasked with bombing Agedabia, the nine P-40s were returning when they encountered five Bf 109s west of Msus. During the mêlée Sgt Plt 'Bleu' Leu made a head-on attack and the Bf 109 was later seen to crash. This was confirmed in a combat report made by Neville Duke. It was Leu's fifth claim and made him an ace.

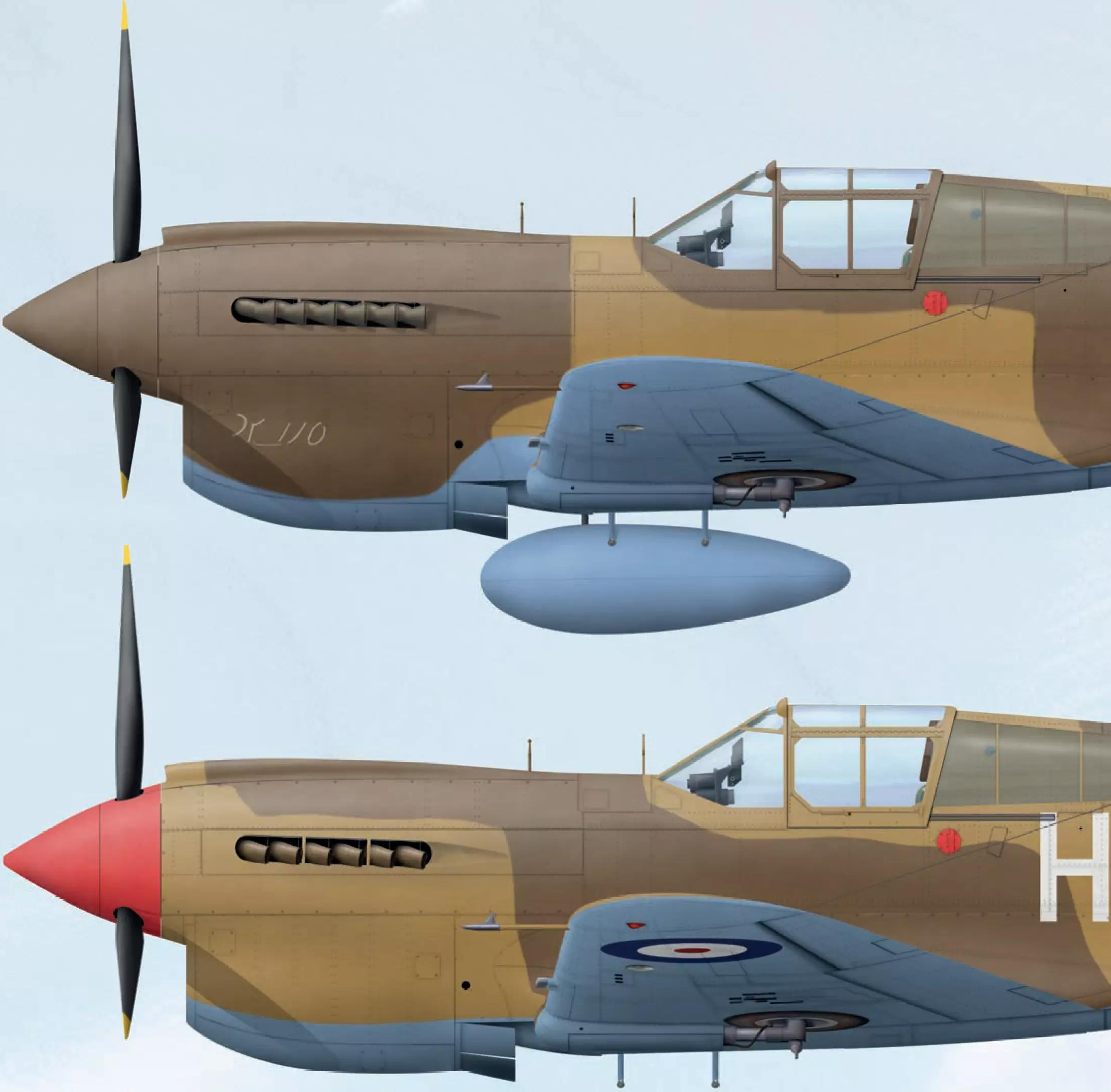
The two squadrons continued to chalk up victories over the Luftwaffe and Regia Aeronautica during the following weeks. They were joined by 250 Squadron and 450 Squadron RAAF on March 1, 1942, when 239 Wing was formed and commanded by Wg Cdr H. C. Mayers. A second wing comprising of a mix of Kittyhawk and Tomahawk squadrons was also formed (all the Tomahawks were eventually replaced), 233 Wing contained 2, 5 and 5 Squadrons SAAF along with 94 and 260 Squadrons.

The squadrons continued with sporadic attacks on enemy targets while attempting to halt Rommel's advance, the tempo changed in September when the Kittyhawks aggressively engaged the enemy aircraft, allowing General Montgomery's forces to build up in preparation for the break out. Following the Battle of El Alamein and subsequent race across the desert the Kittyhawk squadrons operated from temporary airfields as they kept pace with the advance.

Following the surrender of Axis forces in North Africa on May 13, 1943, the squadrons began replacing their aircraft with Mustangs and Spitfires. 112 Squadron retained their P-40s until June 1944, by which time they had flown through Sicily and Italy. The last aerial action for the Kittyhawk was when a dozen 112 Squadron aircraft attacked some Fw 190s taking off from Rieti, Italy, on April 7. The rest of the missions until the end of June were against ground targets and several pilots were lost, the last being Sgt Davis on June 30.

P-40 Kittyhawk

VARIANT	LENGTH	SPAN	HEIGHT	ENGINE
P-40D Kittyhawk Mk I	31ft 2in / 9.50m	37ft 3½in / 11.37m	12ft 4in / 9.66m	Allison V-1710-39
P-40E Kittyhawk Mk IA	31ft 2in / 9.50m	37ft 3½in / 11.37m	12ft 4in / 9.66m	Allison V-1710-39
P-40F Kittyhawk Mk II	31ft ¾in / 9.67m	37ft 3½in / 11.37m	12ft 4in / 9.66m	Packard V-1650-1 Merlin
P-40K Kittyhawk Mk III	31ft ½in / 9.66m	37ft 3½in / 11.37m	12ft 4in / 9.66m	Allison V-1710-39
P-40L Kittyhawk Mk II/III	33ft 4in / 10.16m	37ft 3½in / 11.37m	12ft 4in / 9.66m	Packard V-1650-1 Merlin
P-40M Kittyhawk Mk III	33ft 4in / 10.16m	37ft 3½in / 11.37m	12ft 4in / 9.66m	Packard V-1650-1 Merlin
P-40N Kittyhawk Mk IV	33ft 4in / 10.16m	37ft 3½in / 11.37m	12ft 4in / 9.66m	Allison V-1710-81

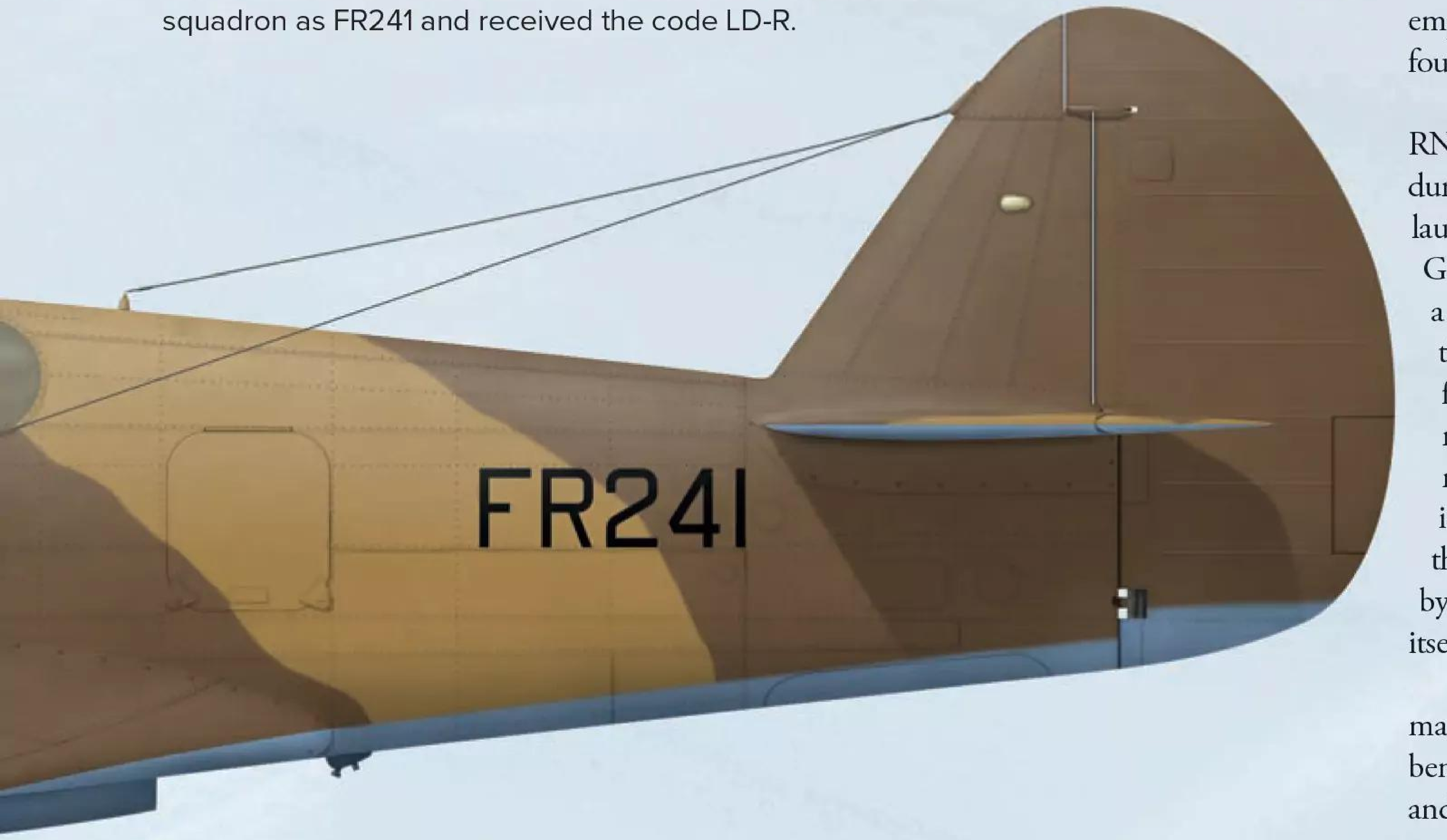


Commonwealth Kittyhawks were not limited to North Africa and Italy, a substantial number being sent to eight RAAF squadrons and seven RNZAF squadrons where they operated throughout the South Pacific. The first posting for 15 Squadron RAAF was to Tonga, relieving the USAAF squadron and allowing it to undertake combat operations. As the campaign continued the squadron island hopped and began encountering Zeros while providing fighter cover over the Russell Islands. Due to the manoeuvrability of the Zeros, the Kittyhawk pilots developed tactics to avoid prolonged dogfights, instead they employed high-speed diving attacks which found some success.

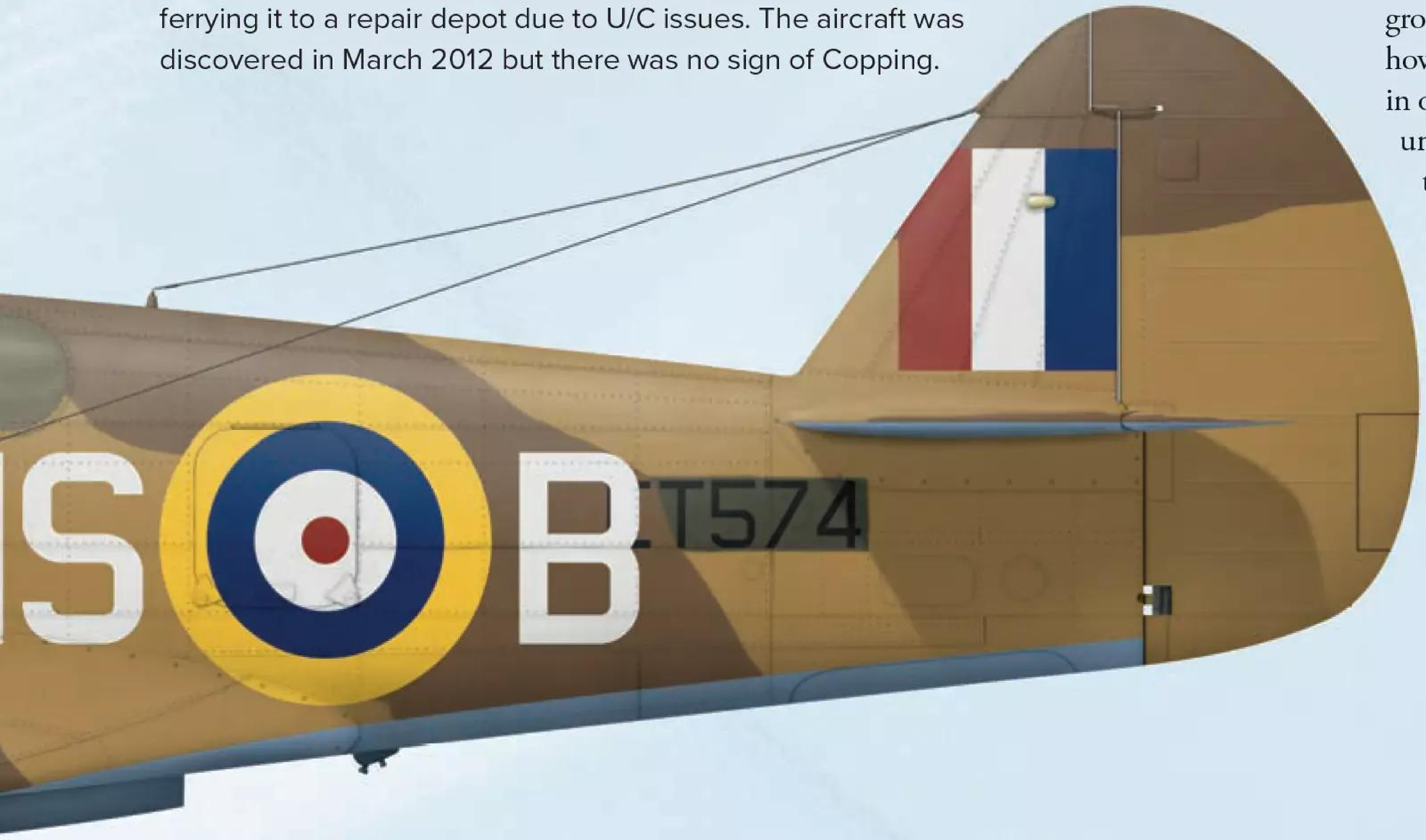
Squadrons from both the RAAF and RNZAF were involved in heavy combat during June 1943 when the Japanese launched a series of bombing raids on Guadalcanal. During this phase of the war a mix of E, K, M and Ns were used by the squadrons supporting the US Marine forces. As aircraft became available the number of squadrons also increased. The method of defending an island and aiding in the invasion of the next continued until the Japanese surrender on August 15, 1945, by which time the Kittyhawk had proven itself a versatile and capable combat aircraft.

Although the P-40 was outclassed in many areas by the end of the war, it had the benefit of comparatively simple construction and low cost production allowing large numbers to be pressed into service quickly. The improvements made to the Tomahawk meant that the Kittyhawk was suited to the ground-attack bomber role. Pilots learned how to exploit the strengths of their aircraft in order to gain results although there was understandable relief when they exchanged their P-40s for later superior fighters. ■

P-40 Kittyhawk Mk.III FR241 112 Squadron
Originally intended for 112 Sqn in the Middle East 42-45831 was painted in RAF colours and received the serial FR241. However, it was actually sent to Alaska and 42-45922 was sent to the squadron as FR241 and received the code LD-R.



P-40 Kittyhawk Mk.III ET574 HS-B 260 Squadron
On June 28, 1942, Flt Sgt Dennis Copping took off in ET574, ferrying it to a repair depot due to U/C issues. The aircraft was discovered in March 2012 but there was no sign of Copping.



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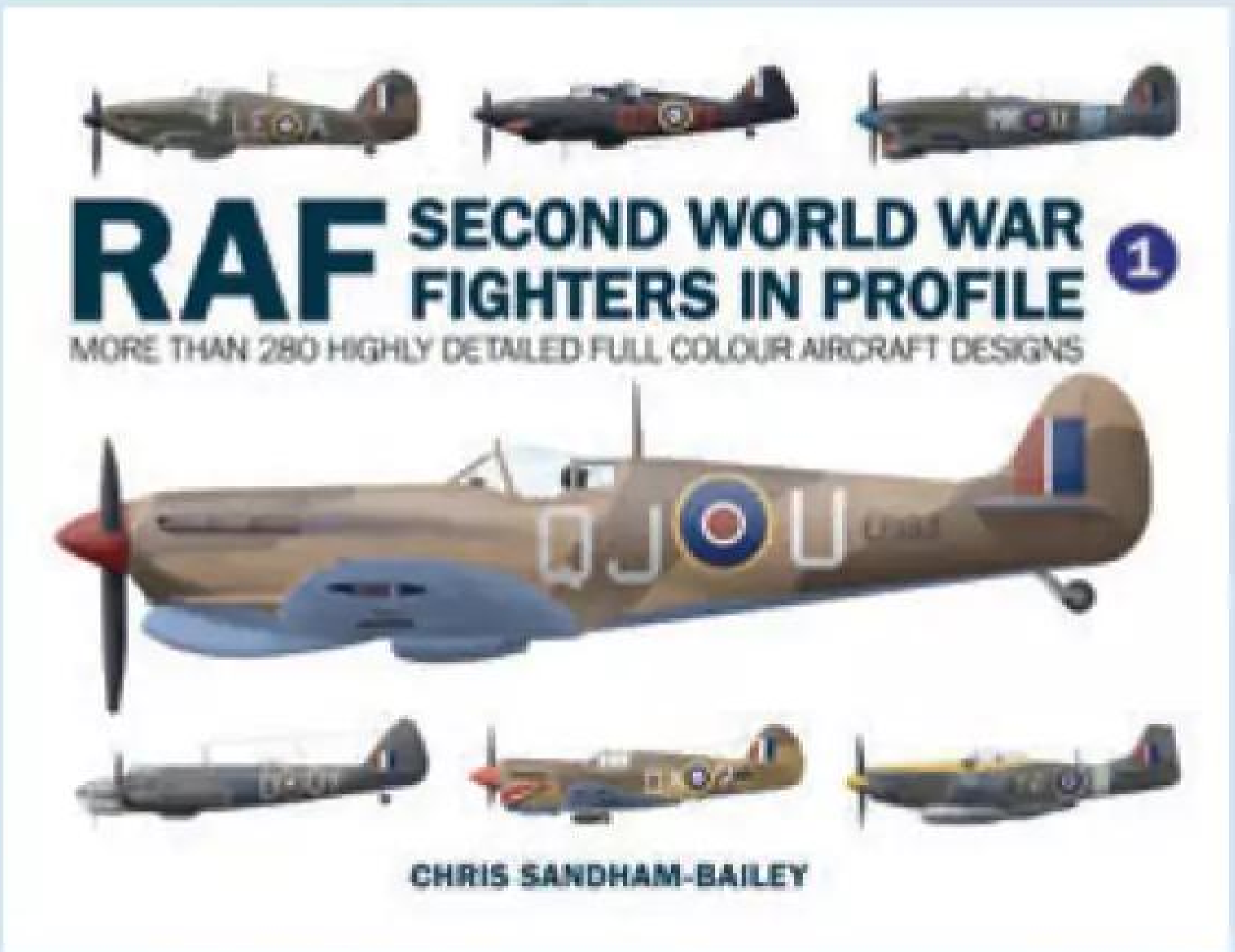
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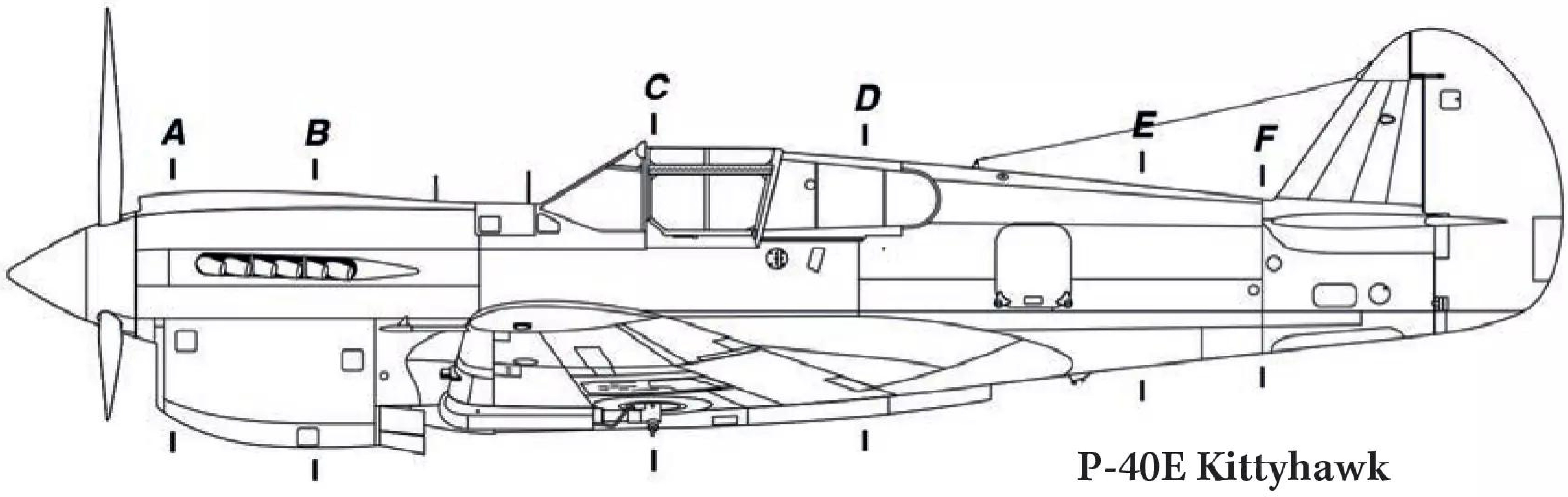
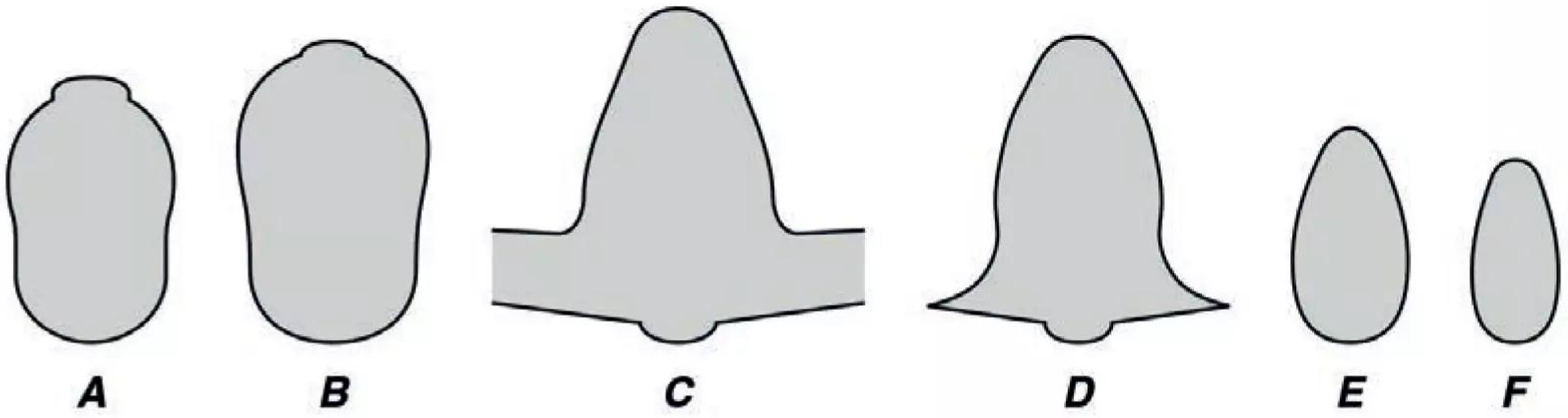
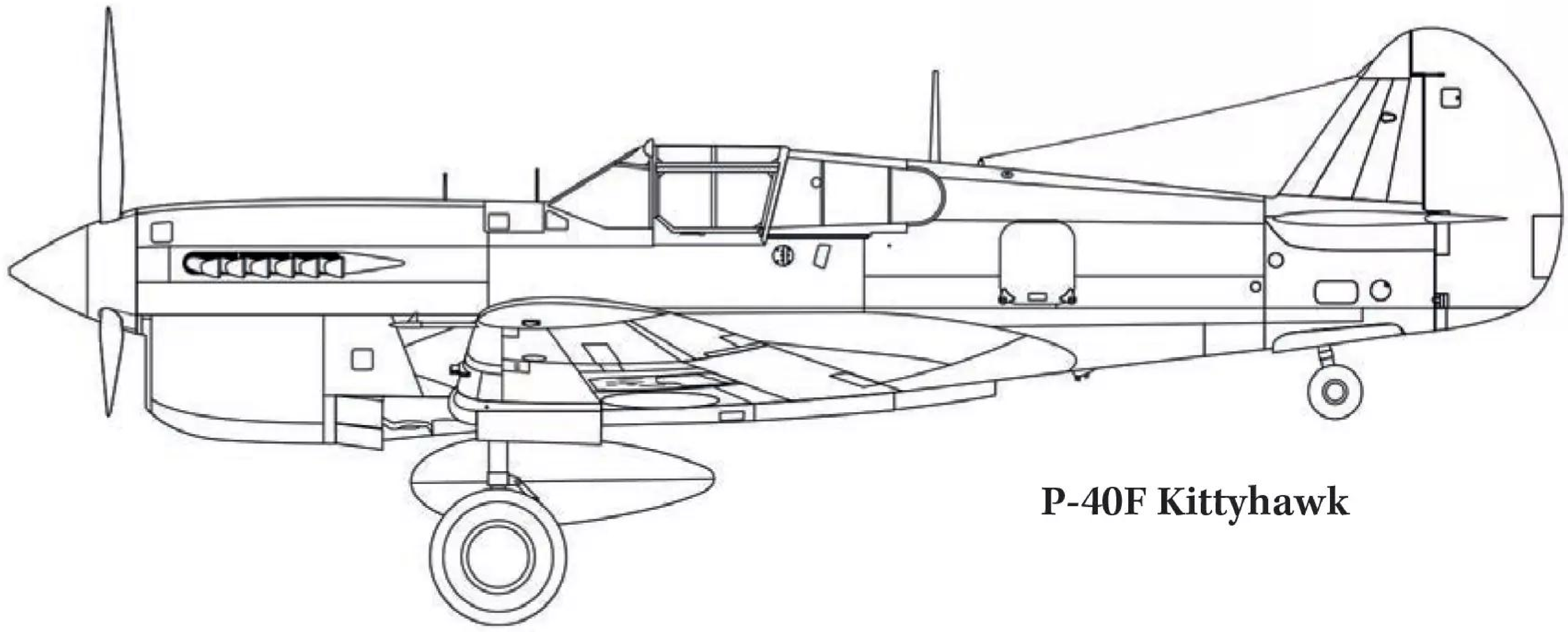
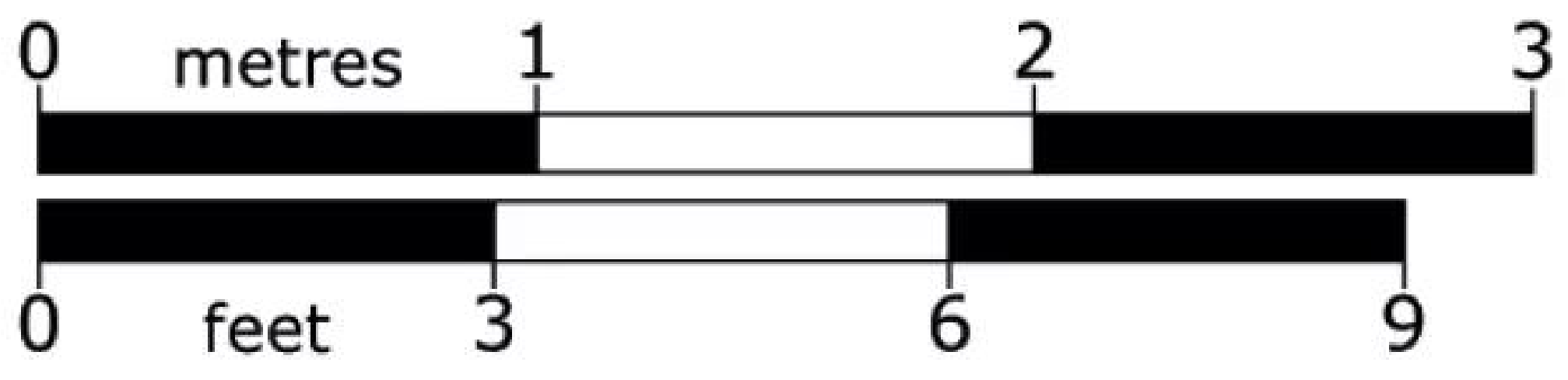


P-40E Kittyhawk





P-40F Kittyhawk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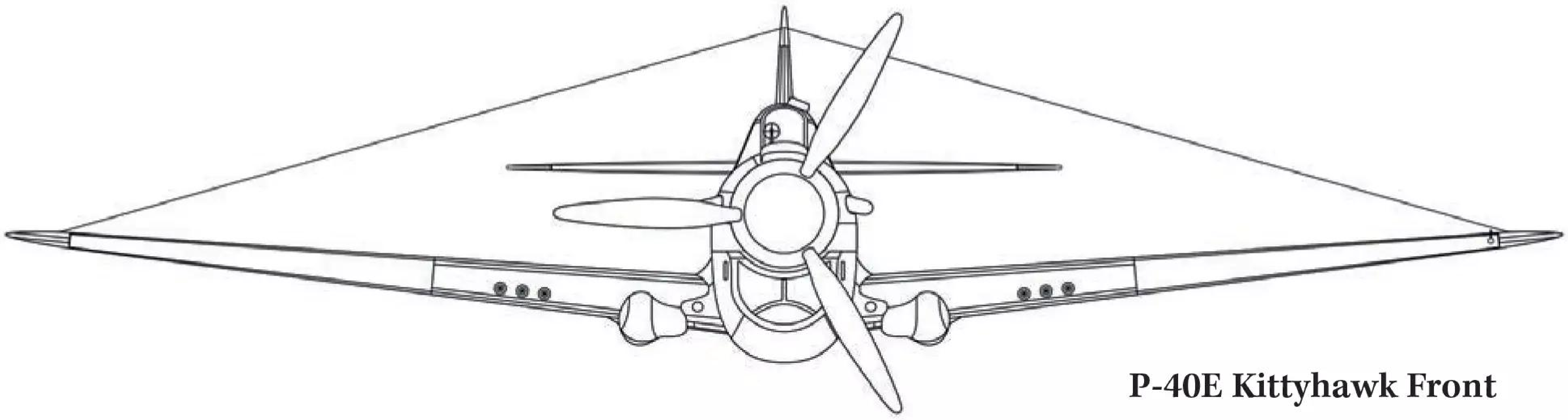
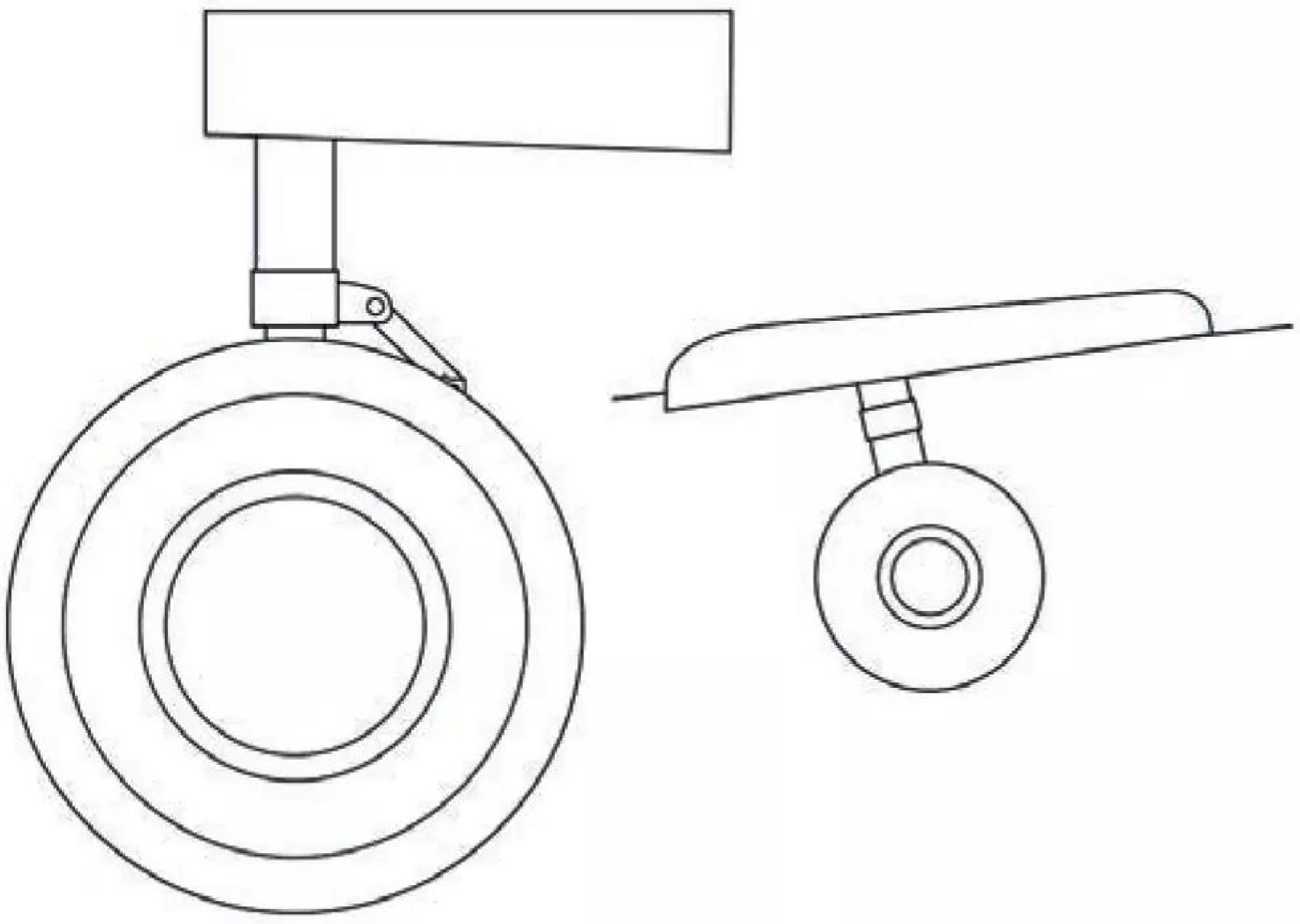
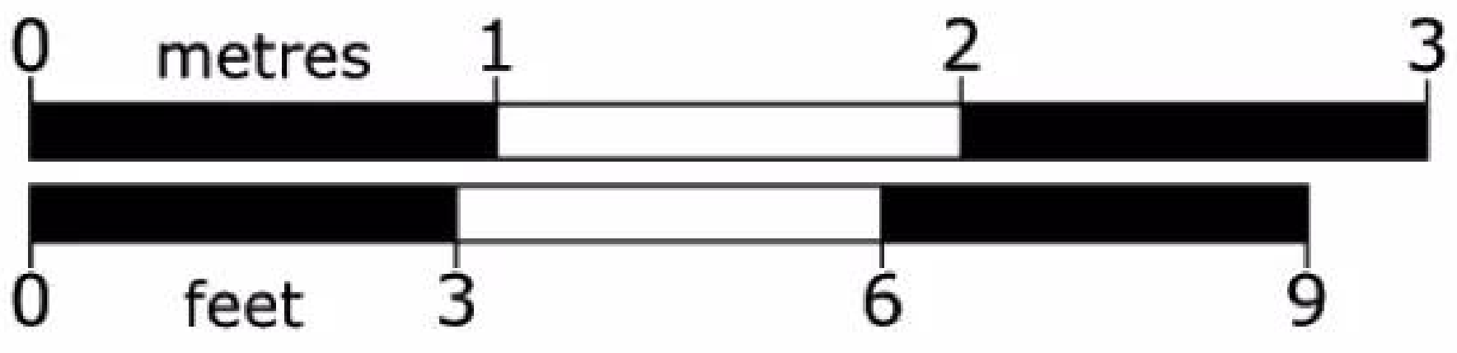


P-40E Kittyhawk Front

Undercarriage Scrap View

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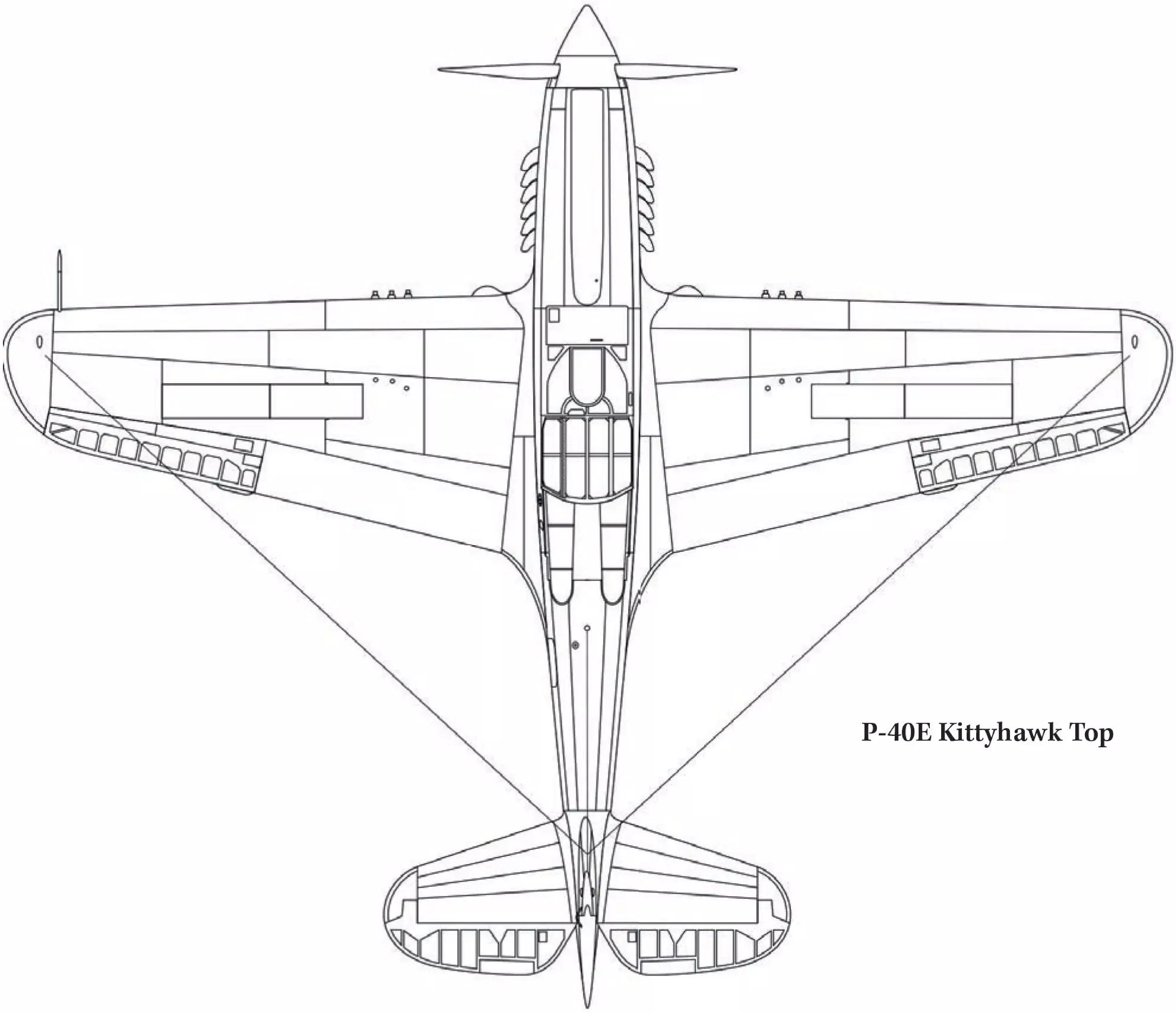
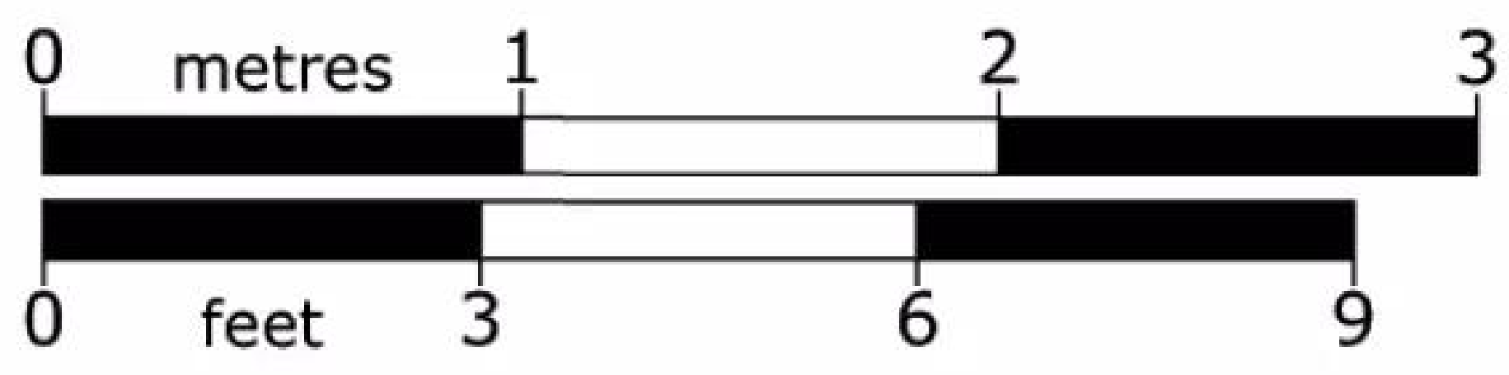


P-40E Kittyhawk Top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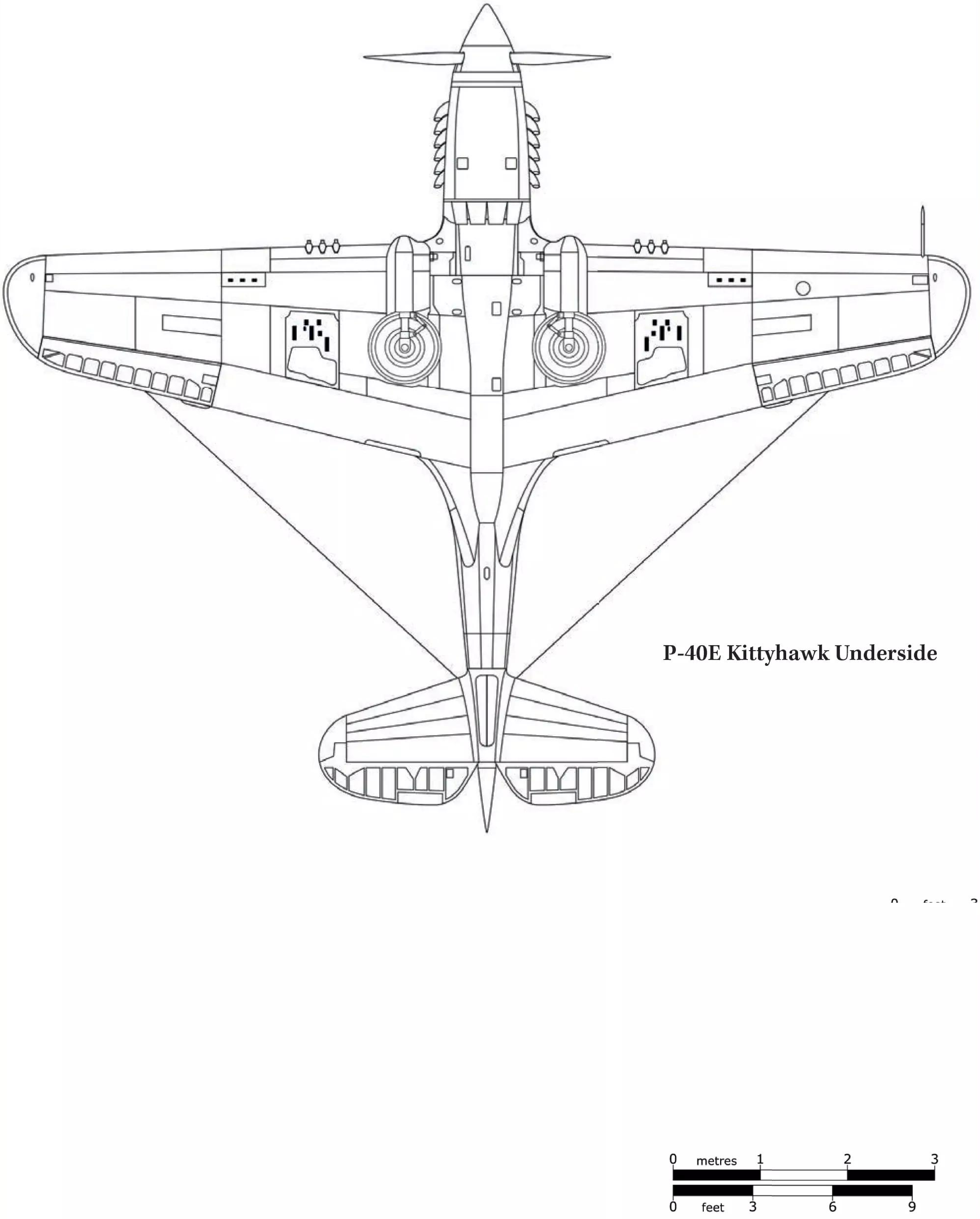
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When Supermarine designed bombers

The collapse of the Conference for the Reduction and Limitation of Armaments in 1934 led to the failure of the League of Nations, heightened global tensions, and a renewed arms race. Germany, emboldened by the absence of international commitment to disarmament, began rearming openly. This action prompted other European nations to follow suit, contributing to the outbreak of the Second World War. Supermarine, makers of the renowned Spitfire began a secret mission to design bombers in preparation of war.

Specification B.1/35

After the collapse of the Conference Armaments and the initiation of the first of several RAF Expansion Schemes, the focus returned to strategic bombers. Vickers' Type 271 twin-engine bomber design, born under the tare weight limitation that Britain had tabled at the conference, was now allowed to grow and after substantial revision sired the Type 285 Wellington. This was considered as a heavy bomber, albeit briefly, along with the Armstrong Whitworth Whitley, before being reclassified as a medium bomber after new specifications were issued.

The first was Specification B.1/35 which called for a twin-engine heavy bomber with a range of 2,000 miles carrying a bomb load of 2,000lb at the highest possible cruising speed, and 1,500 miles at 195mph. The bomber was to be defended by three gun positions; single Lewis guns in the nose and mid-fuselage and two in the tail. The text read: "The ideal to be aimed for is that the gun stations should be dragless…"

The draft specification was circulated to industry in March 1935 with the official document issued in May.

After discussion with McLean in the joint design committee, it was agreed that Vickers should take the lead to develop a project as it could be designed in parallel with the Wellington, with which it would share many features and, indeed, major components. But McLean did authorise Supermarine to carry out a little work on some preliminary schemes as an alternative. Mitchell passed the task to Roger Dickson who, much to his disgust, had been removed from the Spitfire team once it had reached the point where it became a full- blown and high profile project.

Little remains of Dickson's work from this time other than a number of hand-drawn early layouts for various flying boats and one scheme to meet B.1/35. The drawing is dated 7th May 1935 and titled as Scheme 4 Heavy Bomber Landplane A.M. Spec No. B.1/35. There is no sign of schemes 1 to 3, or any later ideas. Dickson had a fine eye for clean aerodynamic lines and Scheme 4 was sketched with minimum drag very much in mind. The fuselage has been drawn with a circular cross section and is only some 5ft in diameter, totally impractical for the storage of a significant load of bombs, so it has to be assumed that at least part of the load was to be carried in the wings.

The cockpit top was raised very slightly from the top line of the fuselage but space in the cabin must still have been very restricted, side windows ahead in the nose were presumably for the navigator. In the extreme nose there is a small hemispherical gun turret, less than 2ft in diameter, which would have required the gunner to operate it from a prone position while having an extremely limited view.

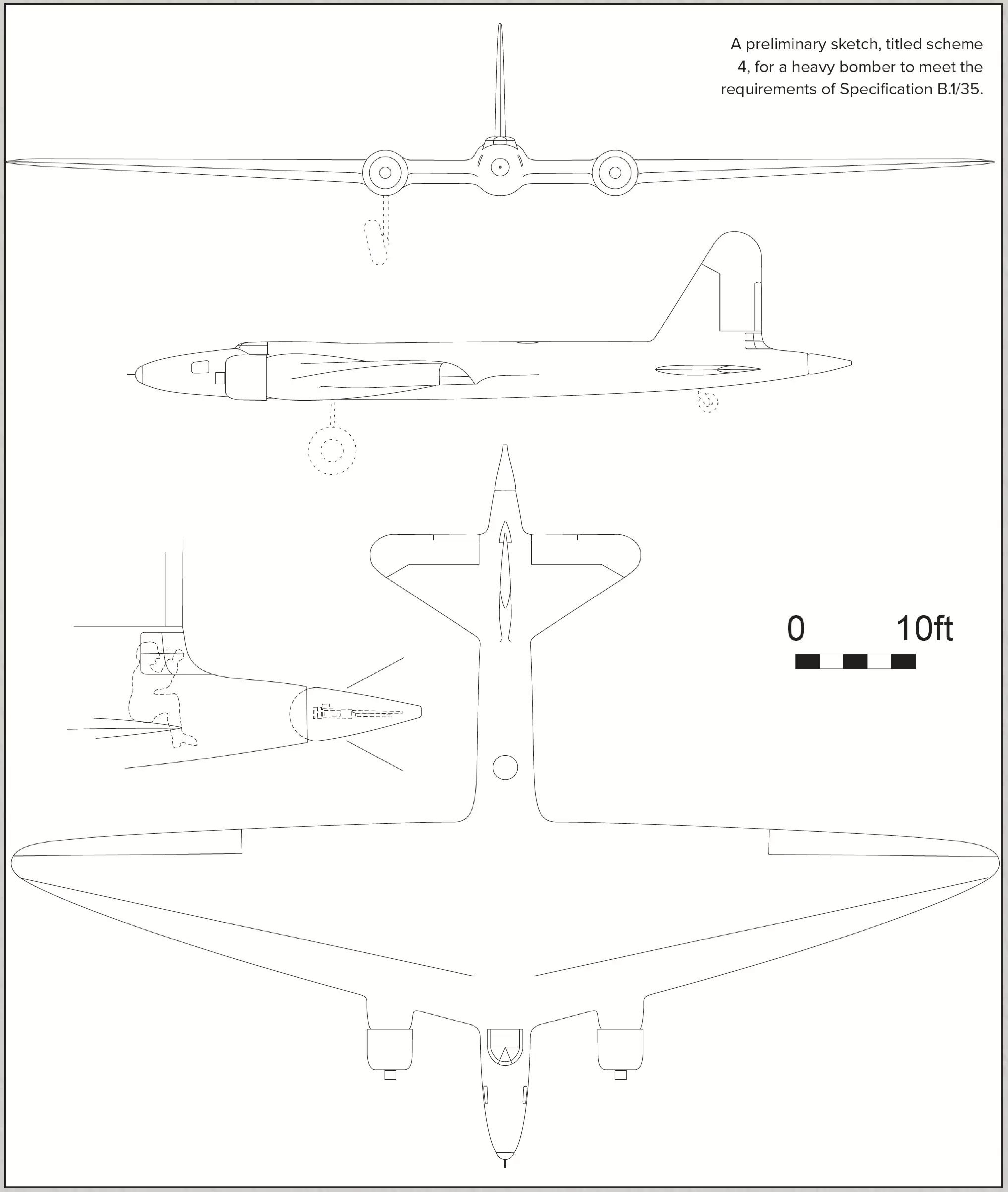
A circular hatch in the fuselage roof behind the wings is probably an indication of the location of a retractable dorsal gun turret. The tail turret is novel and is also a feature of a military version of the civil flying boat project Type 306. The gunner sits some way back from the tail with his head in a glazed enclosure directly below the rudder. The two guns would be installed in a special elongated conical housing that formed an extension of the tail of the fuselage. The base of the cone had a hemispherical shape so that it could be swivelled to aim the gun.

There was a single large fin and rudder and a tailplane with sharp sweep on the leading edge.

The wings are clearly designed to use the single spar system and the spar is swept back by 12 degrees. The rear false spar is straight. Both the leading and trailing edges are drawn with a very small amount of curvature but for practical purposes the leading edge can be said to have a sweep of 16 degrees and the trailing edge swept forward by 2.5 degrees as far out as the ailerons. The total span was just short of 100ft, the maximum allowed by the specification. The engine mounts placed the engines some distance ahead of the wing with their thrust line aligned with the wing mid chord. The engines are identified as Twin Aquilas, an engine that did not actually exist and was probably intended to mean the Taurus, a 14-cylinder twin-row radial based on the nine-cylinder single-row Aquila, which did exist. The Taurus was a sleeve-valve engine of relatively small diameter and produced around 1,000hp, probably rather low for an aircraft of this size.

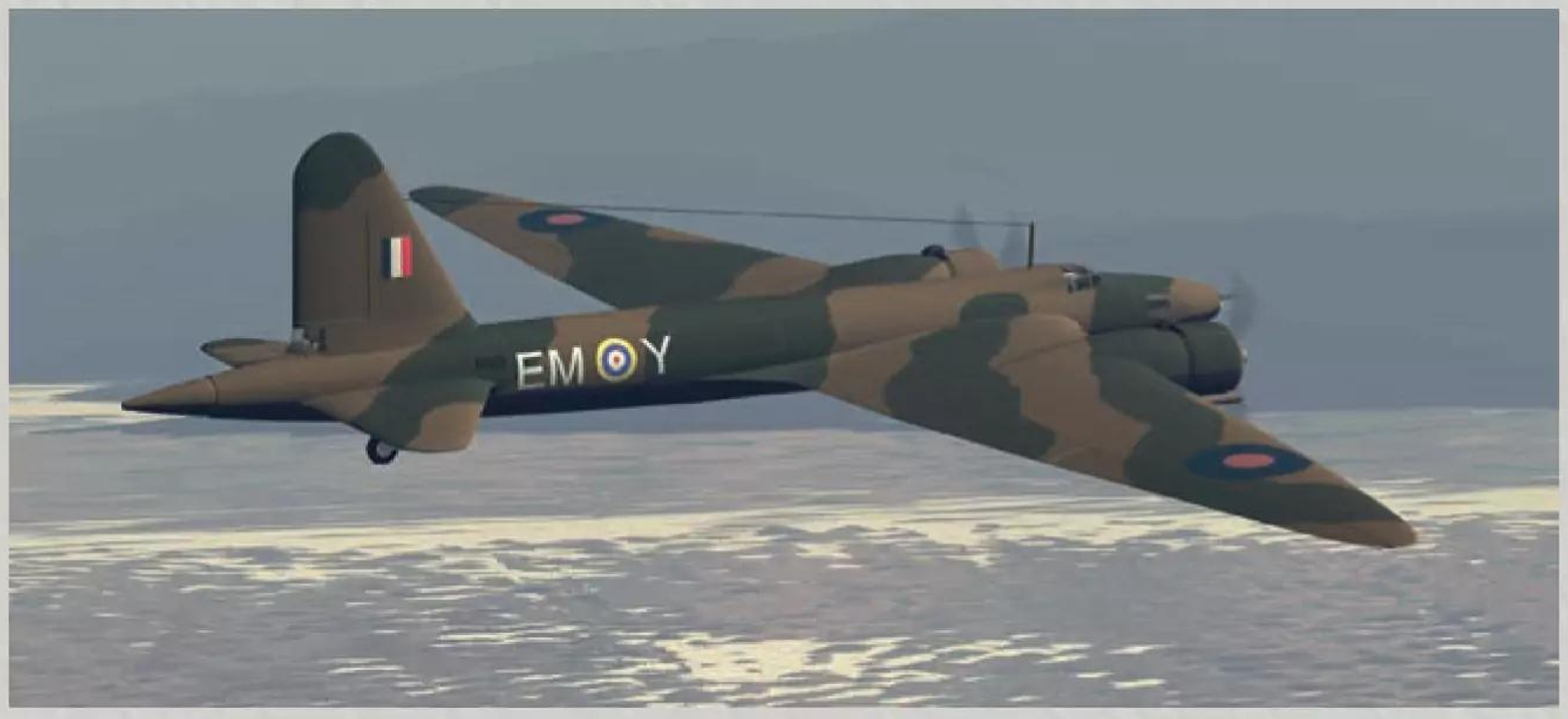
The main undercarriage consisted of large single wheel units under the nacelles. It is almost certain that Dickson intended these units to retract rearwards while rotating through 90 degrees around the axis of the main leg, a system that he and Supermarine had patented the previous year.

The tail wheel was retractable too. Scheme 4 is clearly not much more than a sketch of a possible configuration for


A preliminary sketch, titled scheme 4, for a heavy bomber to meet the requirements of Specification B.1/35.

discussion as there are plenty of features that would have proven unacceptable for a service aircraft. There are elements that were to reappear in the next large bomber design but by this time Dickson had quit, disenchanted with the lack of opportunity for promotion within Supermarine, and gone to work for Saunders-Roe. He would return to Supermarine once war broke out.

B.1/35 was not destined to be a success. It had been perceived as a replacement for the Armstrong Whitworth Whitley, a bomber rushed through under the first RAF Expansion Scheme with Specification B.3/34 virtually written around it, which had fallen out of favour long before it had even flown. B.1/35 suffered the same fate. Although the Vickers Warwick was awarded a contract, that too was overtaken by the bomber specifications issued in 1936: B.12/36 and P.13/36. ➤



B.1/35 project in flight – note the tail gun and gunner's cockpit located beneath the rudder.

Specification B.12/36 – Types 316 and 317

Once the Spitfire prototype had passed its official trials it was rushed forward for production and Mitchell could shift his focus to other projects.

There were both civil and military flying boat designs demanding his attention but one that seems to have been of especial interest was the bomber Specification B.12/36, issued in May 1936.

The escalation in rearmament worldwide, catalysed by the growing martial attitude of several authoritarian regimes, was helping to drive forward the development of new technologies across the board. No sooner had a specification been raised for a new service aircraft type than the prospect of even higher-powered engines, improvements in structures, aerodynamics, and armament incentivised the issue of more specifications for yet more capable aircraft types. And so it was that no sooner was the ink dry on B.1/35 than the Air Ministry concluded that a new heavy bomber class should have four engines, a far higher bomb load and increased defensive capability.

Now that Germany was looking increasingly to be the adversary in any future war RAF bombers would need the range to reach strategic targets anywhere in the country and the speed and armament to be able to be able to defend themselves as they penetrated deep into enemy airspace.

B.12/36 was the first specification calling for such a heavy four-engined bomber for worldwide use that requested "…an aircraft that can exploit the alternatives between long range and a very heavy bomb load which is made possible by catapult launching in an overload condition. The aircraft must possess high performance but at the same time be strong in defence against attack from any direction."

As with B.1/35, the span of the aircraft was restricted to a maximum of 100ft, often said to have been dictated by the size of RAF hangar doors but now shown to been a rather arbitrary number selected simply to keep the aircraft size down to perceived manageable proportions.

While formulating the operational requirement, serious concerns had been expressed about the length of the take-off run for such a large aircraft so the specification set out a number of scenarios, some that would require the use of an accelerated or catapulted system to assist take-off.

The cruising speed at two-thirds power was to be not less than 230mph at 15,000ft.

The maximum number of bombs to be carried was 28, either 250lb or 500lb of various types, and seven of the carriers should be capable of holding 2,000lb AP bombs. Various combinations of bomb type could be required to make up the load. The defensive armament was "two forward guns in a power operated turret. Two guns amidships in a semi-streamlined and retractable turret beneath the fuselage. Four tail guns in a power operated turret. 1,000 rounds of ammunition per gun"

And finally, just to complicate matters further, the specification added: "Consideration is to be given in design for fitting a light removable form of seating for the maximum number of personnel that can be accommodated within the fuselage when the aircraft is being used for reinforcing Overseas Commands". That was a somewhat vague statement open to wide interpretation.

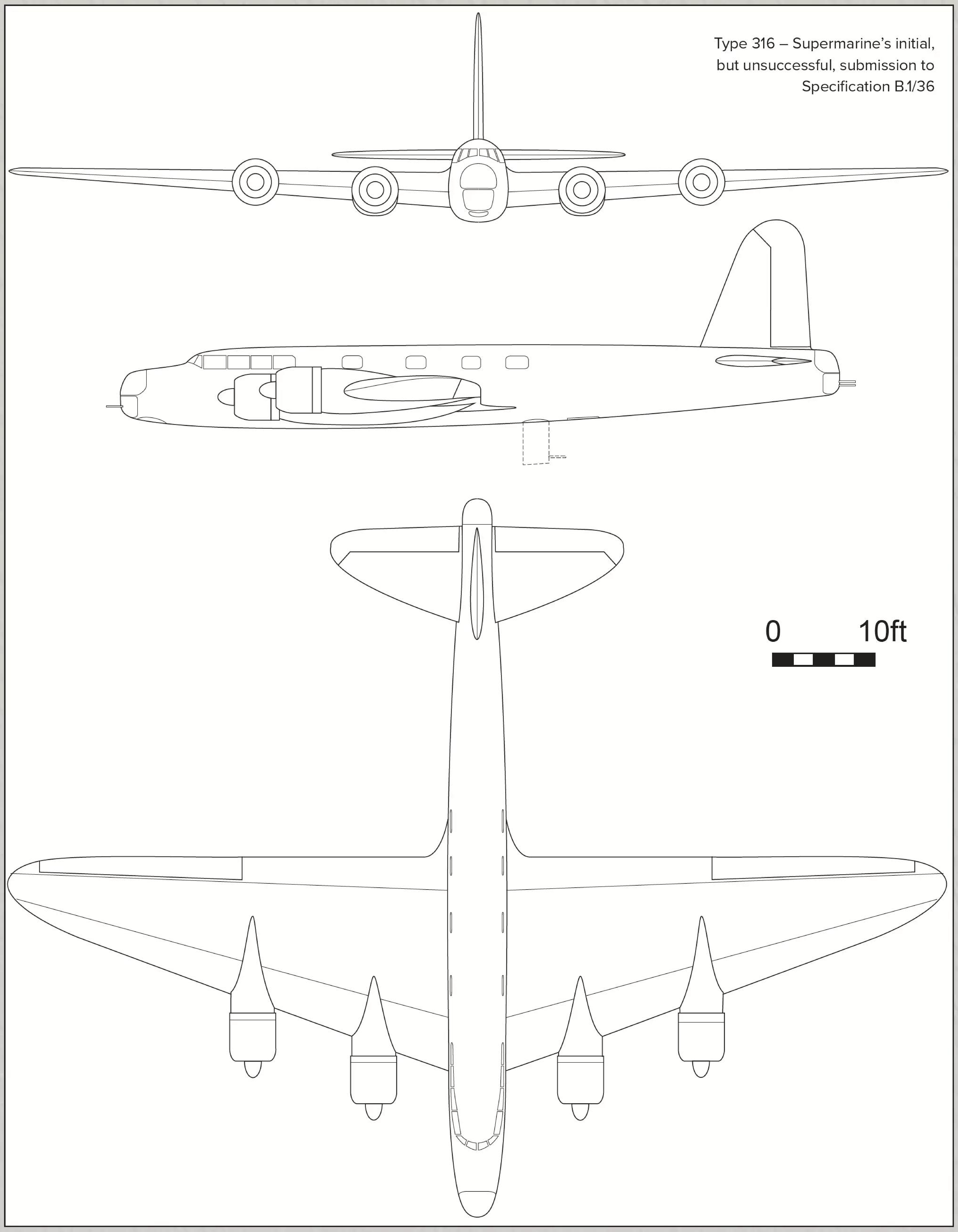
Bomb load	Range	Take-off run
2,000lb	1,500 miles	500 yards (standard)
4,000lb	2,000 miles	700 yards
8,000lb	3,000 miles	accelerated
14,000lb	2,000 miles	accelerated

Mitchell and the team commenced work on the Type 316, and it is obvious that the new bomber project was derived from, or at the very least drew inspiration from, Dickson's layout for the B.1/35 bomber. Mitchell pursued the same philosophy in the design as he had for the Spitfire; there was to be no compromise to performance and refined aerodynamic design was given high priority. The concept of a wing with swept leading edge and single fin came directly from the B.1/35 scheme while the fuselage was redesigned to provide more practical internal space. The wing used the NACA 2416 aerofoil at the root. And the sweep on the leading edge had been increased to 20 degrees and to 15 degrees on the spar. The entire interior volume of the leading edge torsion box, with the exception of the tip and portions that included the engine mounts, was used for the fuel tanks.

The fundamental problem when designing a bomber to meet the taxing demands of the specification was how to carry the very large number of bombs required for the overload case without the aircraft becoming so bulky that the performance was impacted adversely. An obvious solution was to carry part of the bomb load within the wing and it was here that Supermarine's single spar wing came to the fore as it provided a great deal of storage capacity to the rear of the spar between the ribs.

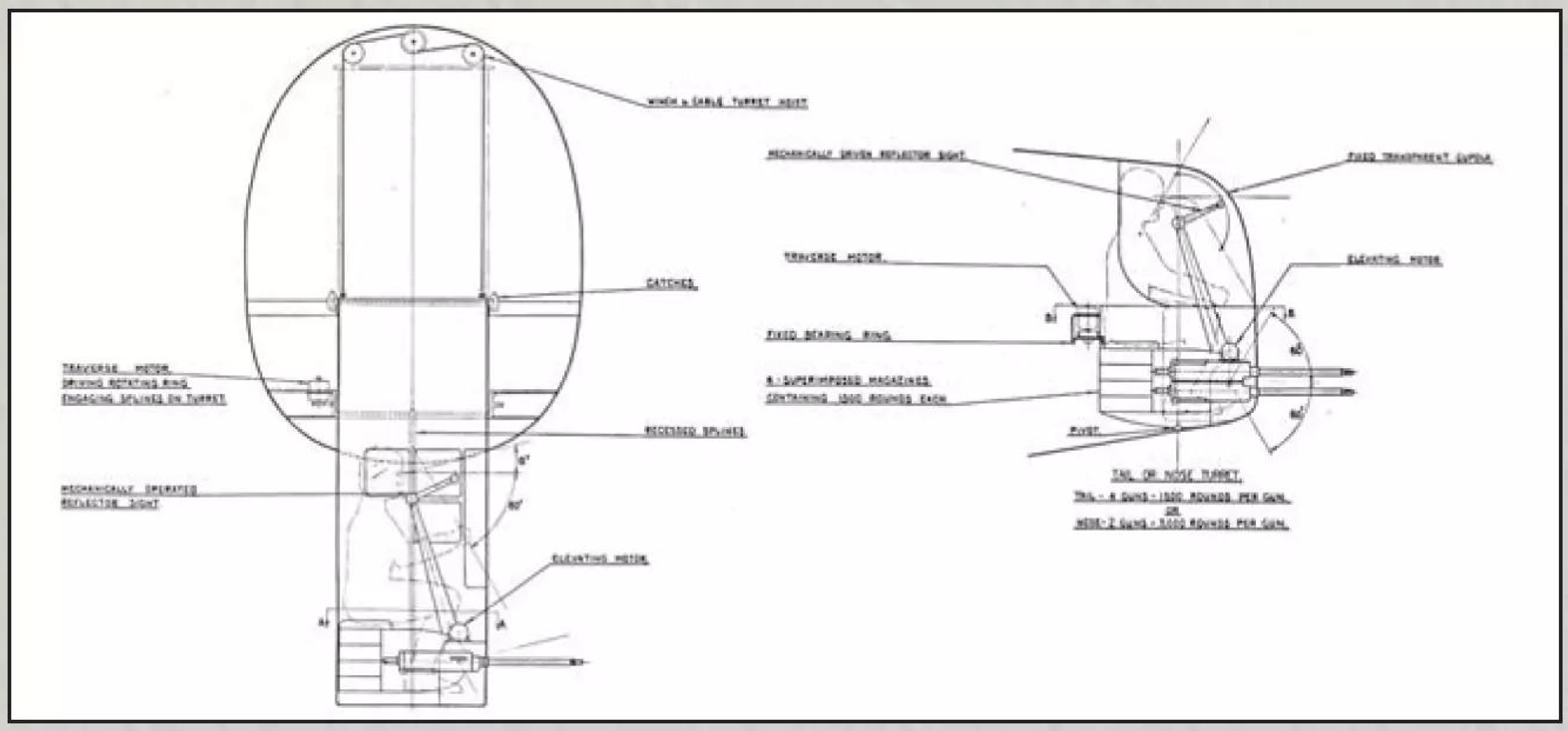
To maximise the space available, the spar of the Type 316 reverted closer to the 25% chord position as used for the Spitfire; other contemporaneous projects placed this at the point of maximum aerofoil thickness at 30% chord. This provided sufficient space to carry both 250lb and 500lb bombs right out as far as the nacelles for the outer engines while the two bays closest to the wing root were long and deep enough to accommodate the larger 2,000lb bombs.

There were ten bomb bays in each wing leaving just nine to be installed in the lower fuselage – with plenty of space above for the transport of troops. Supermarine estimated that had all the bombs been carried within the fuselage it would have needed to be 42% larger while the wings would have remained the same size.

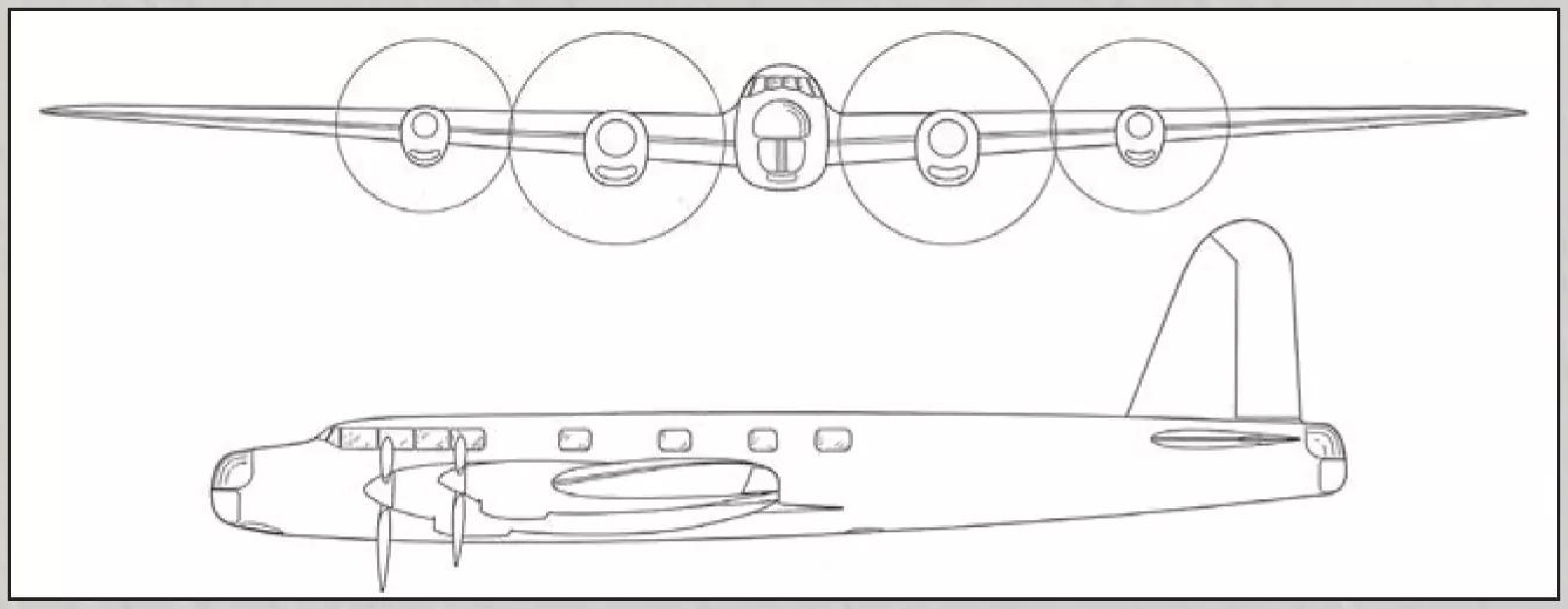


Type 316 – Supermarine's initial, but unsuccessful, submission to Specification B.1/36

Mitchell decided that the team should design 'bespoke' gun turrets tailored to the form of the fuselage to minimise drag. Wilfred Kimber, an engineer in the technical office, devised an ingenious scheme for a turret where the guns were installed in a cylindrical tub with the gunner's seat and sight fixed in place directly above. The guns could elevate through an aperture in the ➤


WINCH & CABLE TURRET HOIST
CATCHES
TRAVERSE MOTOR DRIVING ROTATING RING ENGAGING SPLINES ON TURRET
RECESSED SPLINES
MECHANICALLY OPERATED REFLECTOR SIGHT
ELEVATING MOTOR
MECHANICALLY DRIVEN REFLECTOR SIGHT
FIXED TRANSPARENT CUPOLA
TRAVERSE MOTOR
ELEVATING MOTOR
FIXED BEARING RING
4 - SUPERIMPOSED MAGAZINES CONTAINING 1000 ROUNDS EACH
PIVOT
TAIL OR NOSE TURRET
TAIL - 4 GUNS - 1000 ROUNDS PER GUN
OR
NOSE - 2 GUNS - 2000 ROUNDS PER GUN
60°
60°

Supermarine Type 321 Mk IV gun turrets.



The Type 316 – an alternative, powered by two Rolls-Royce Vultures in the inner nacelles and Kestrel KV26s in the outers.

front of the tub, with a range of 60 degrees up and down, and track by rotating the whole unit, which could turn by 100 degrees on each side. When used as a nose or tail turret the gunner was enclosed within a non-rotating cupola that was shaped to the profile of the fuselage. For use as a ventral turret, the tub was fitted at the base of a retractable cylindrical enclosure with windows for the gunner and the whole unit was able to rotate through a full 360 degrees. The turret design was of sufficient promise that it was allocated its own project number, Type 321, and was the subject of a patent application in 1937.

The Type 316 was designed so that it could be powered by a variety of different engine types. The primary choice being between Bristol Hercules and Rolls-Royce Merlins but alternatives included the Bristol Pegasus, Napier Dagger and the interesting combination of Rolls-Royce Vultures as the inner engines and Rolls-Royce Kestrel KV26s (Peregrines) as the outers. With the most powerful option, the 1,300hp Hercules, the top speed was estimated as an impressive 370mph, a speed which would have taxed a Spitfire. Cruising speed on two-thirds power with a full load of 14,000lb and fuel for 2,000 miles was 306mph at 18,000ft.

Mitchell sent the brochure to the Air Ministry in September where it was reviewed the following month along with submissions received from Boulton-Paul, Vickers, Armstrong Whitworth and Short Bros. It was ranked fourth with Vickers first, but uncertainty remained and no decisions were forthcoming. Finding his design ranked next to bottom, just ahead of Short Bros, whose design was judged "…too near flying boat design", was not good enough for Mitchell who immediately requested a meeting with AMRD and Ministry officials, which took place on 24 November.

There are no records of what took place in this meeting but Mitchell certainly proved remarkably persuasive as Supermarine was effectively given another chance to submit a proposal followed in January 1937 by AMRD recommending that Supermarine should receive an order for two prototypes. Meanwhile on 12 January the Supermarine design team held a conference where they reached agreement on how the project should be reworked, based on Mitchell's interpretation of the reasons for the Air Ministry's rather negative evaluation. What they came up with was a complete rethink of the aircraft.

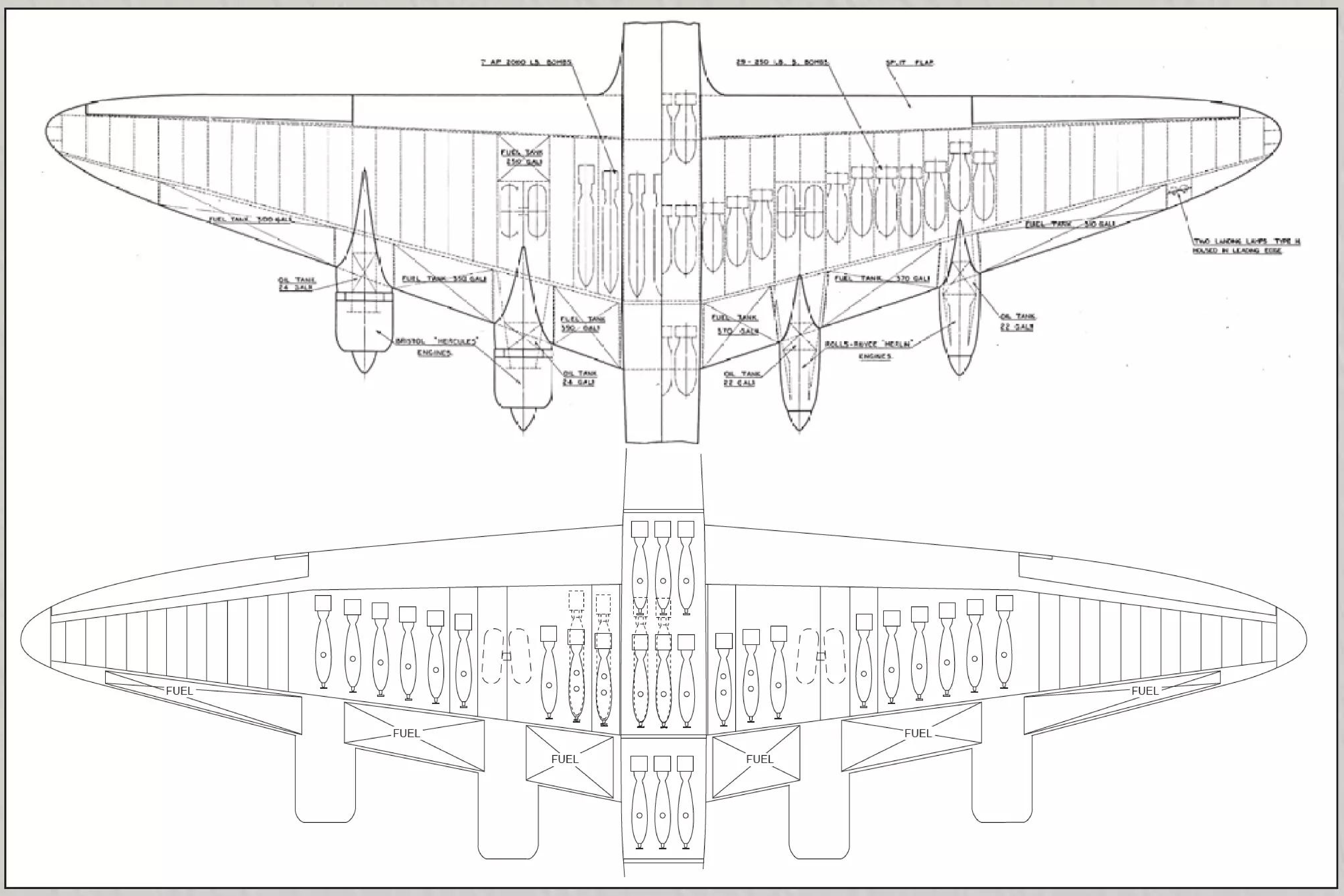
The original Type 316 design had a 'life' of no more than six months before it was discarded, yet it is this that has appeared most often in articles, artwork and books rather than the final version, for which the company was to receive an order and on which construction work commenced.

No doubt this is because for the first there was a brochure which included multiple illustrations, while for the new design there was not. Every part of the aircraft was redesigned from scratch – this was in no way a modification of the initial design. The redesign continued under the same Type 316 designation and was carried out largely without the input of Mitchell whose health was failing fast, to the extent that he was unable to work in the office after February and very soon thereafter unable to contribute to the project at all.

The main decision taken at the conference was to increase the area of the wing and also of the flaps to address concerns around the landing speed. Then the lines of the fuselage come under the spotlight and it was slimmed down at the rear. The jury remained out on the configuration of the tail surfaces, with uncertainly whether a single or double fin arrangement was preferable. In early March drawings were dispatched to the wood shop in order to produce 1:24 scale models for evaluation in Vickers' wind tunnel. There do not appear to have been any wind tunnel tests carried out on the original design.

The tests confirmed the design, the twin tail was adopted and detailed design work continued. A mock-up of the fuselage was constructed over the summer and a mock-up conference was held on 12 August. There were some reservations about the lack of headroom in the cockpit, where it was not possible to stand up, so the wind tunnel model was adjusted to assess the effects of a higher roofline for the forward fuselage. The results are not known but no change was made to the design. Somewhere around this time the project was renumbered as Type 317, for the prime version with Hercules engine, and Type 318 for that with Merlins. No drawings are known to have survived that have a Type 318 number, but these would most probably only have covered changes to the engine mounts and nacelles. As the Air Ministry had instructed Supermarine to terminate work on this version in July it is quite possible that no formal drawings were ever produced.

The wing owed nothing to the earlier design. The span had been increased by 4ft to 97ft. The main spar was now swept at 7 degrees and the inner section of the wing, from root to the outer nacelles had straight taper with 11 degrees of sweep and wider


7 AP 2000 LB. BOMBS
25 - 250 LB. S. BOMBS
SPLIT FLAP
FUEL TANK 350 GALS
FUEL TANK 300 GALS
OIL TANK 24 GALS
FUEL TANK 350 GALS
BRISTOL "HERCULES" ENGINES
FUEL TANK 350 GALS
OIL TANK 24 GALS
FUEL TANK 370 GALS
OIL TANK 22 GALS
ROLLS-ROYCE "MERLIN" ENGINES
FUEL TANK 370 GALS
OIL TANK 22 GALS
FUEL TANK 310 GALS
TWO LANDING LAMPS TYPE H HOUSED IN LEADING EDGE
FUEL
FUEL
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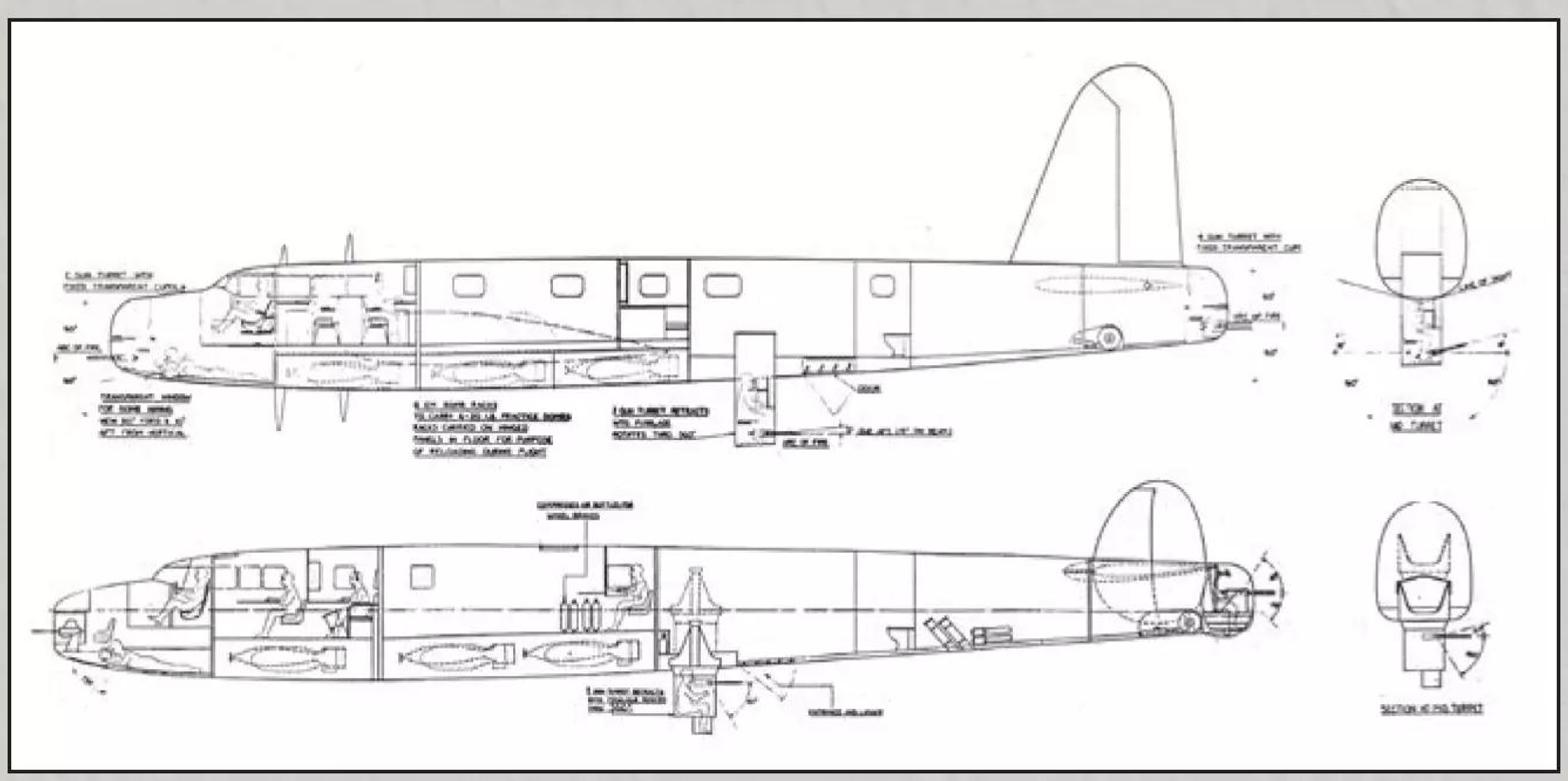
Bomb storage with the wings of the Type 316 and Type 317.



The interior layouts of the Type 316 and Type 317 bombers.

spacing of the engine nacelles compared to the Type 316. Dihedral, measured on the top of the spar, was 1.5 degrees. The outer section had 15 degrees of sweep, curving into the tip and the trailing edge was modified elliptical from aileron to tip.

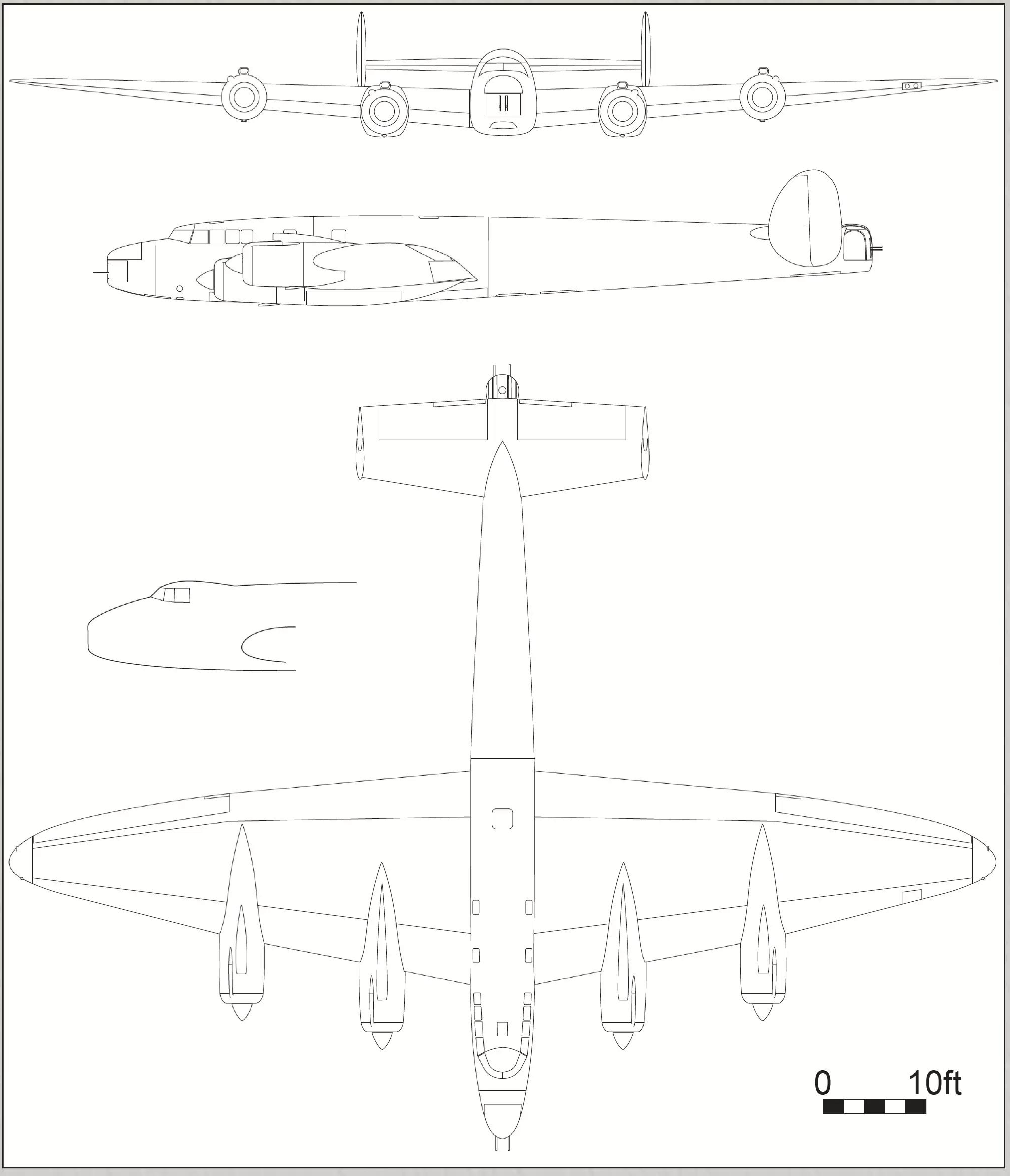
The aerofoil section was from the NACA 2200 series, as selected for the Spitfire, with 18% t/c ratio at the root tapering to 12% at the outer engine nacelles, thus providing increased depth over the bomb cells. Nevertheless, the number of cells was reduced to nine per wing. As before, fuel tanks occupied the entire leading edge torsion box except behind the engines.

Development of the Type 321 gun turret was abandoned. The Air Ministry wished to focus on a restricted number of turret types that could be installed on any aircraft and presumably advised Supermarine that its design would not be supported. Fortuitously, Barnes Wallis had developed a low drag type for installation in the first batch of Wellington bombers and it looks to be almost certain that a version of this was adapted to fit the nose of the Type 317.

As with the Supermarine design, the canopy over the gunner was shaped to conform to the nose of the aircraft and was fixed. The guns were set low in the turret and extended through what Wallis referred to as an 'articulated band' which was a series of vertical slats, hinged together along their long sides, that ran in tracks at the top and bottom and moved as the guns traversed, somewhat in the manner of a roll-top desk or a roller garage door. The vertical slots provided in the band for the guns had flexible rubber seals on either side that acted as a wind break as the guns were elevated or depressed.

The bomb aimer's window was directly under the guns and gave a view from directly down to 75 degrees forward, with the aimer lying prone, his head tight against the front gunner's seat, which was far from perfect. For the rear and ventral turrets the team had to select from existing types and chose Nash & Thompson FN.IV for the tail and FN.XIX for the ventral 'bin'. The FN.IV was not ideal as it was slightly wider than the rear of the fuselage, so presumably the original intent was to fit some other, unknown, type.

The nacelles for the engines were designed for minimum drag and dispensed with the adjustable gills for cooling air ➤

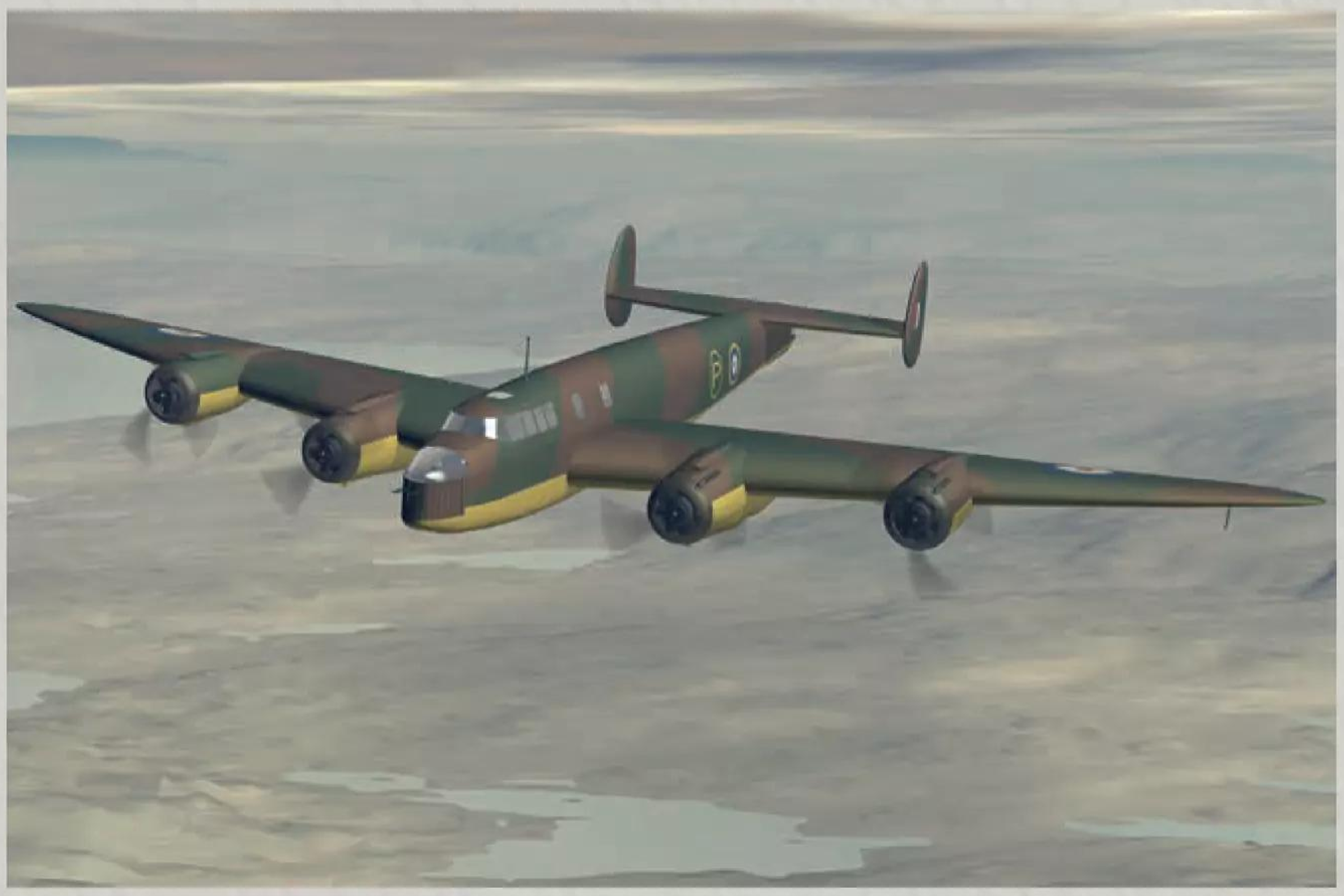


The definitive design for the Type 317 bomber – 1939. Inset shows the raised cockpit tested in the wind tunnel.

usually fitted just to the rear of the engine. Instead the air passed through a shaped duct to exit under the wing. In order to keep the width of the rear part on the nacelle to a minimum the aircraft had twin wheels on each main undercarriage unit that were toed-in to fit. The space in the nacelle was so tight that the top of the hydraulic ram that retracted the wheels required a small blister on the top of the nacelle and this was enclosed in a rearward extension of the fairing for the engine air intake.

To summarise, every measure had been taken to reduce drag to a minimum, every part trimmed back while ensuring that the aircraft remained entirely practical for the missions it would undertake. The wing and fuselage were all metal covered, mostly Alclad, and flush riveted.

After detailed design and numerous wind-tunnel tests the final configuration was



How the Type 317 prototype could have looked.

expected to have a top speed of 330mph, a cruising speed of 290mph at 15,000ft and combinations of range and load that all exceeded the specification requirements by a comfortable margin, although lower than the initial estimates for the Type 316.

How did the competition compare? The Armstrong Whitworth A.W.42 showed a clear family resemblance to the Whitley and was powered by four Rolls-Royce Merlins. However, the published figures for this design appear erroneous, the carriage of up to 42 bombs is not compatible with the layout drawings and a top speed of 370mph looks beyond optimistic.

Boulton-Paul submitted the BP90 where all the bombs were carried within the fuselage on rotary racks. Inevitably it was large but was estimated to meet all of the requirements. The Bristol design was submitted late and only reviewed in mid-1937 and the Short Bros submission failed to meet the wingspan limitation and the company was asked to submit a revised design. Given the tendency of Arthur Gouge, chief designer at Shorts, to reuse design elements in his projects it is more than likely that the initial submission would have had much in common with the S25 Sunderland flying boat, then under construction.

Gouge's wing design was based on a large box spar with the fuel tanks built within, hence carriage of the bombs had to be entirely within the fuselage. Vickers, as Short Bros, wanted to extract the maximum value from their existing designs and hence their submission, the Type 293, employed geodetic construction and resembled the Warwick and Wellington, apart from the adoption of an elliptical wing. As geodetic construction of the wings made the internal carriage of bombs complex, all had to be carried in the fuselage which consequently was large.

Supermarine's Type 317 was clearly superior to the others in terms of efficiency of construction and estimated performance but there were concerns whether the company was capable of producing the aircraft in a timely manner. As noted earlier, construction of the Itchen works and extensions at Woolston was complete but the available space was earmarked for the 310 Spitfires that had been ordered. The design department were overwhelmed as they rushed to produce the production drawings for the Spitfire to a suitable standard for the many subcontractors that were involved in the undertaking.

As a consequence, Short Bros was awarded a contract for its revised design, the S.29 Stirling, selected ahead of the other competitors mainly, it would seem, because the company had proven expertise in building four-engine cantilever monoplanes. The Air Ministry concerns about Supermarine's ability to build the prototypes in a timely fashion were proven justified as the design work dragged on well into 1939, by which time the Stirling prototype had already flown. The multiple blueprints that have survived show the pressure the company was under; the standard is no doubt fine but they are in many cases the original drawings and not the cleaned-up traced versions that would have been produced had more time been available.

By the summer of 1940 construction was moving at a snail's pace with only the fuselages for the two prototypes nearing completion. When Supermarine's works were bombed in September, both were damaged and the Air Ministry decided to terminate the contract since further delay was unacceptable.

B.12/36 was a demanding specification and most of the designs tendered were unremarkable. The Type 317 stood out from the crowd, and least on paper, but were the performance estimates achievable? That has to remain unknown but given the long delays in getting the prototype completed it is also largely academic as bomber design and the bombing policy that sired them, had moved on, not to mention the axe wielded by the Ministry of Aircraft Production (MAP) to focus resources on a restricted number of aircraft types.

The Short Stirling crashed at the end of its first flight when the undercarriage collapsed on landing. However, with time running out it was ordered for production. The aircraft came nowhere nearing achieving the performance required for B.12/36; a top speed of 260mph and a range of 1,930 miles carrying 5,000lb of bombs and 740 miles with 14,000lb. Nevertheless, it was the RAF's first heavy four-engine bomber and served well until it was replaced by the Handley-Page Halifax and Avro Lancaster. ■

For more, see:
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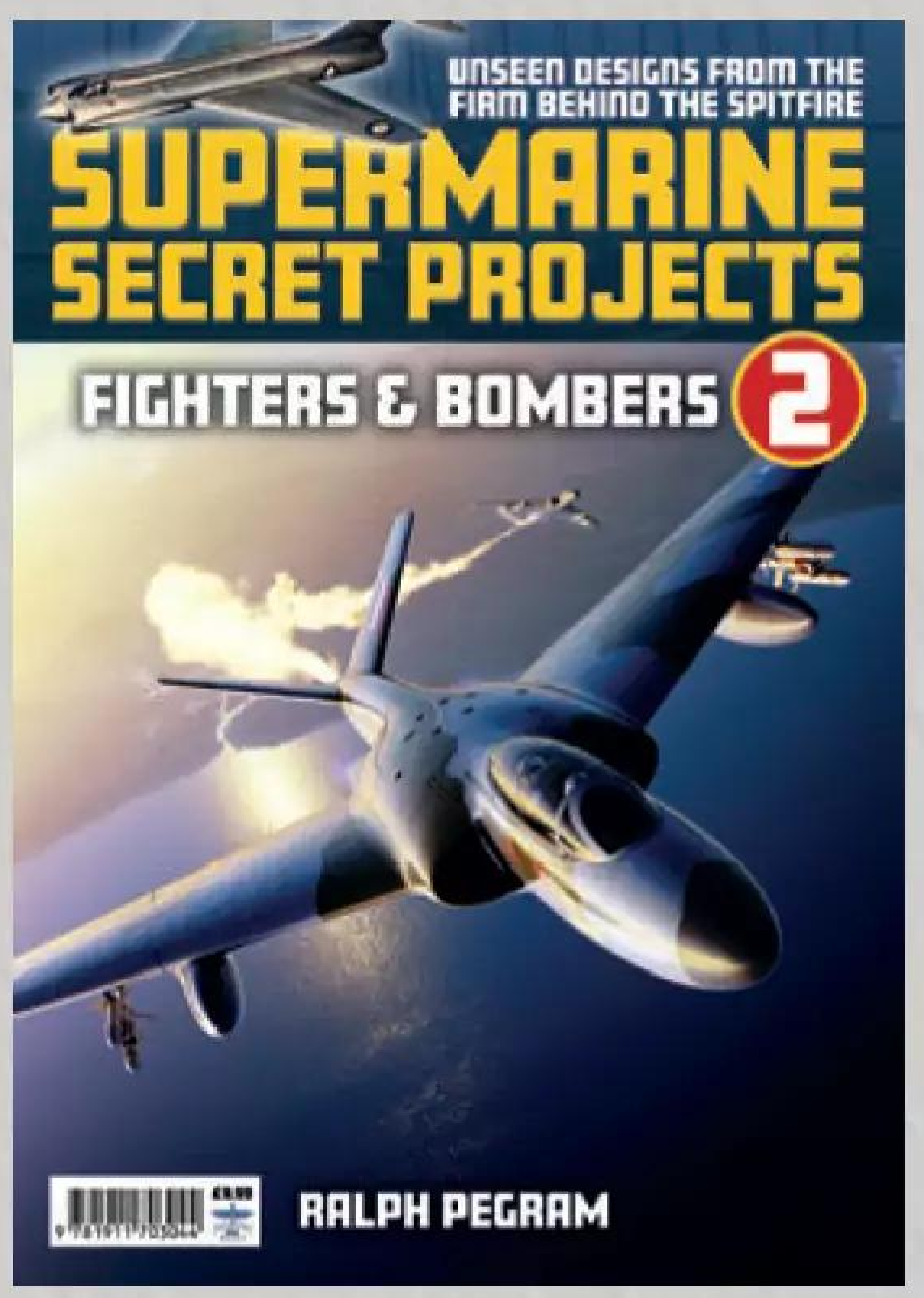
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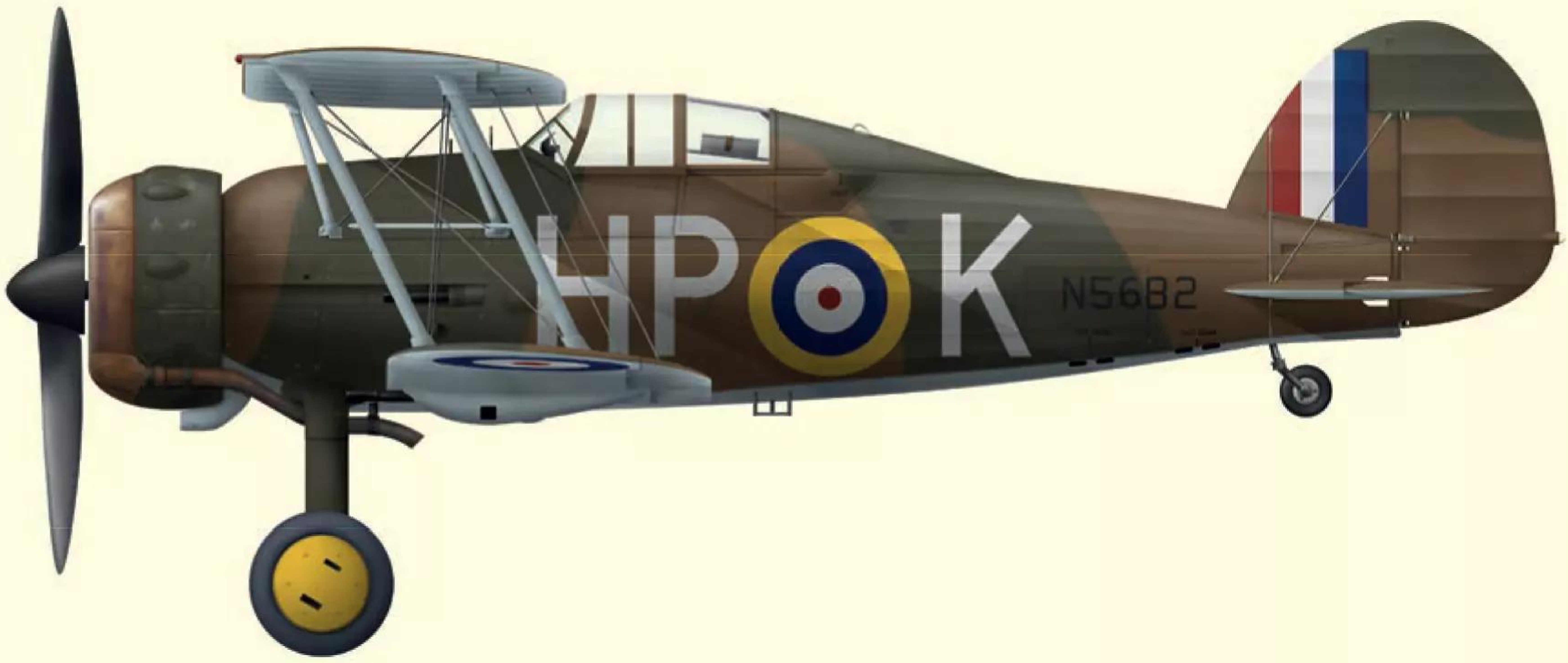
FW 190 – FIGHTING TO THE END IN DEFENCE OF THE REICH



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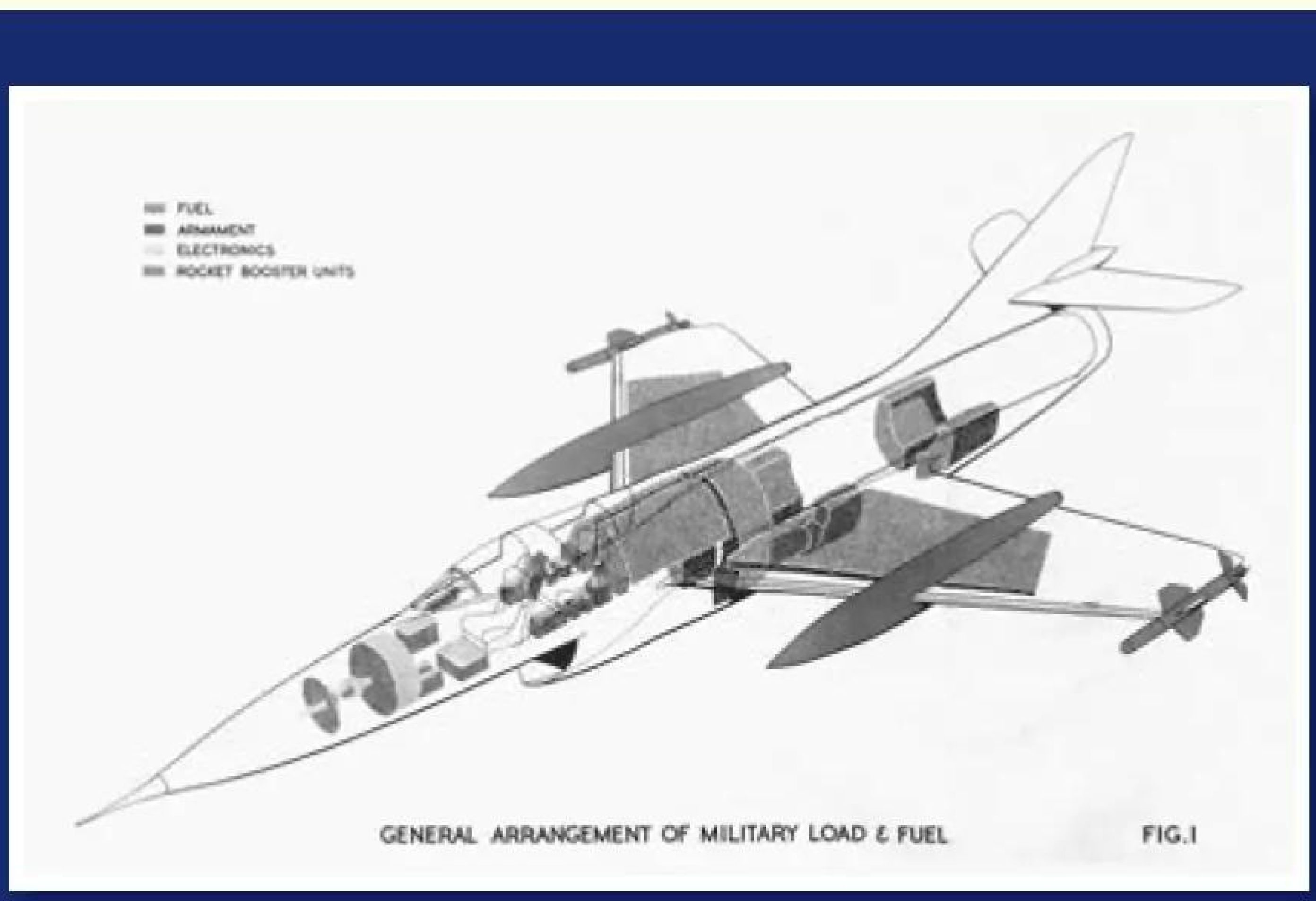
FUEL
ARMAMENT
ELECTRONICS
ROCKET BOOSTER UNITS
GENERAL ARRANGEMENT OF MILITARY LOAD & FUEL
FIG.1

Hawker's lost interceptor: the P.1103.

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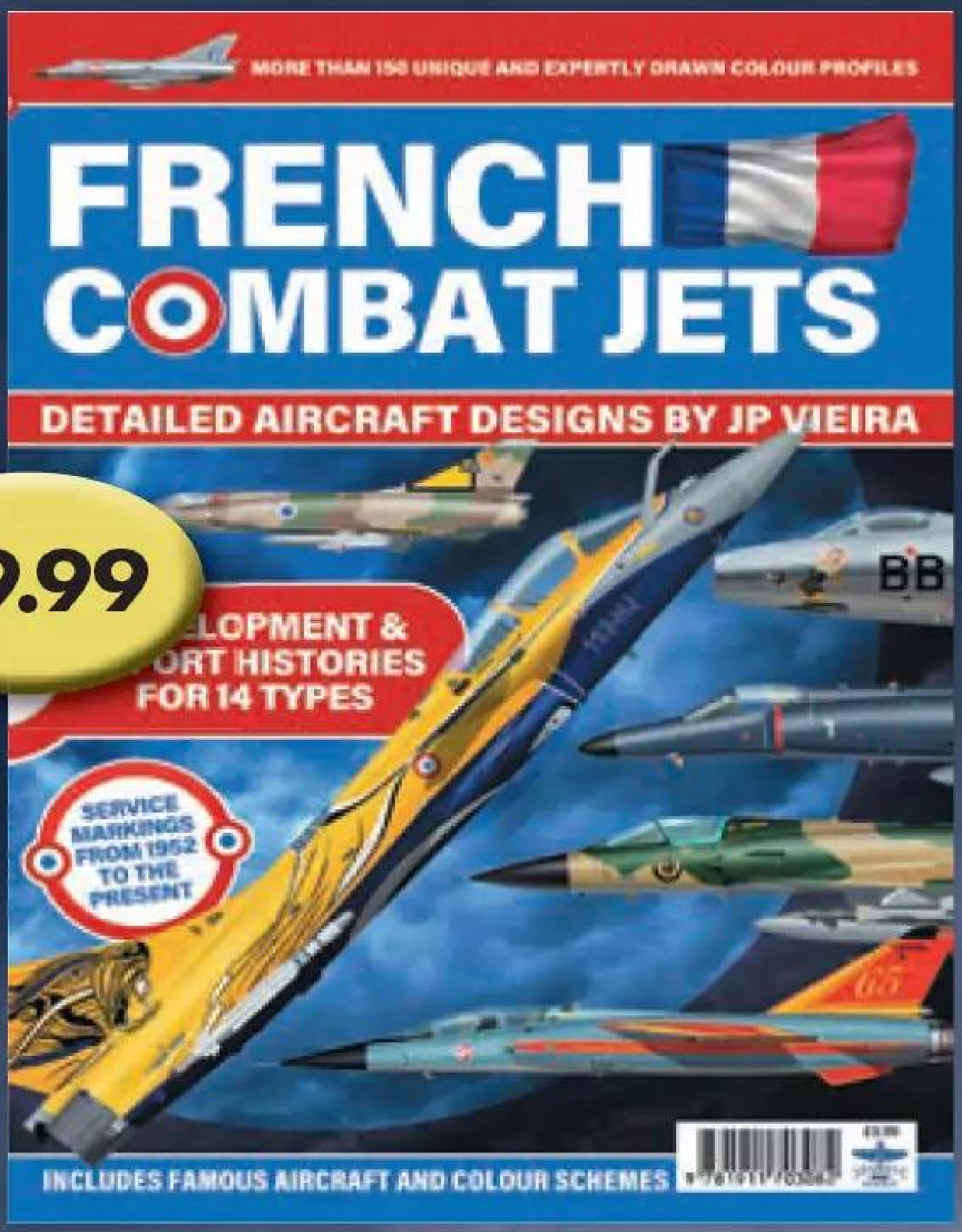
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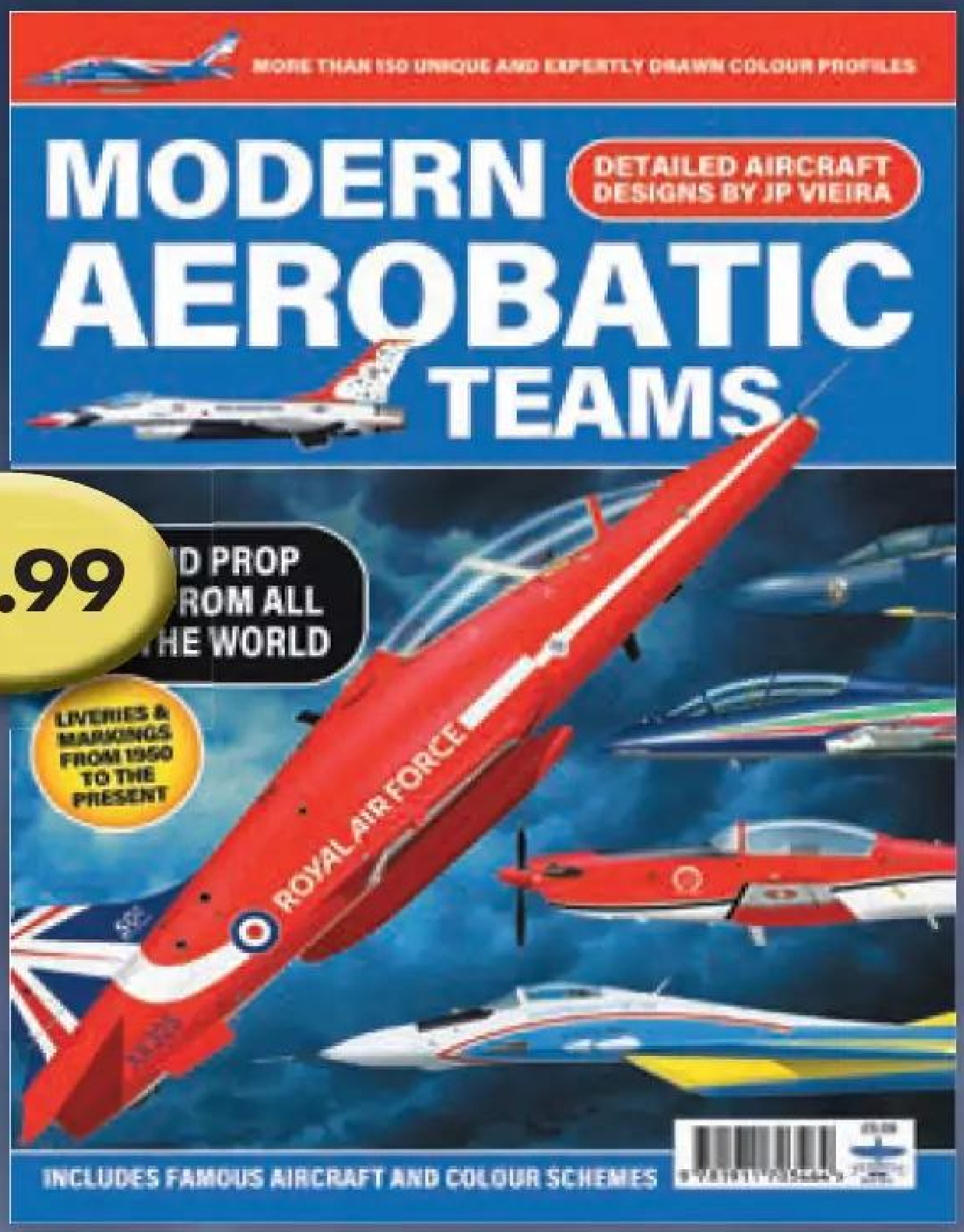
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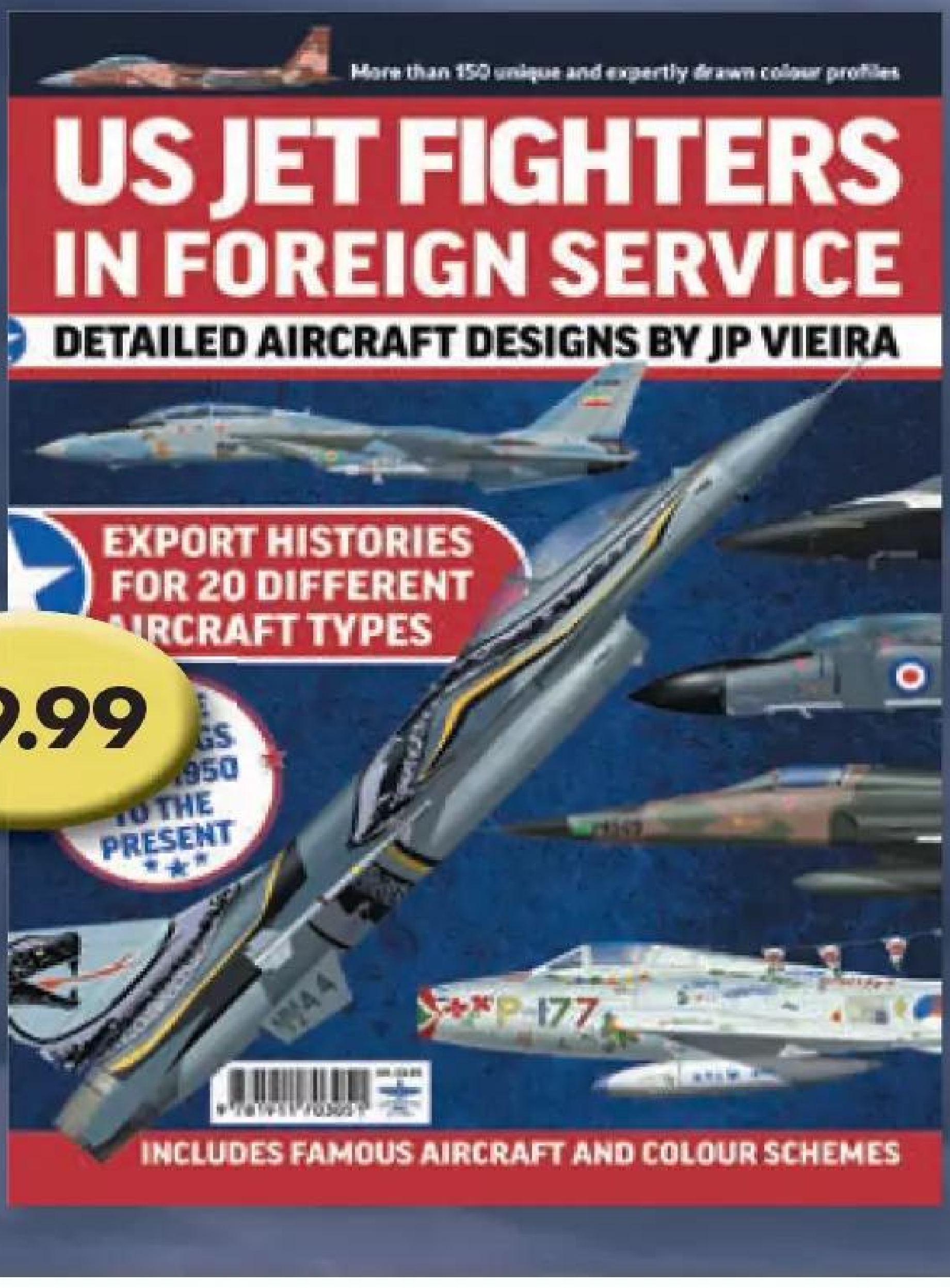
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